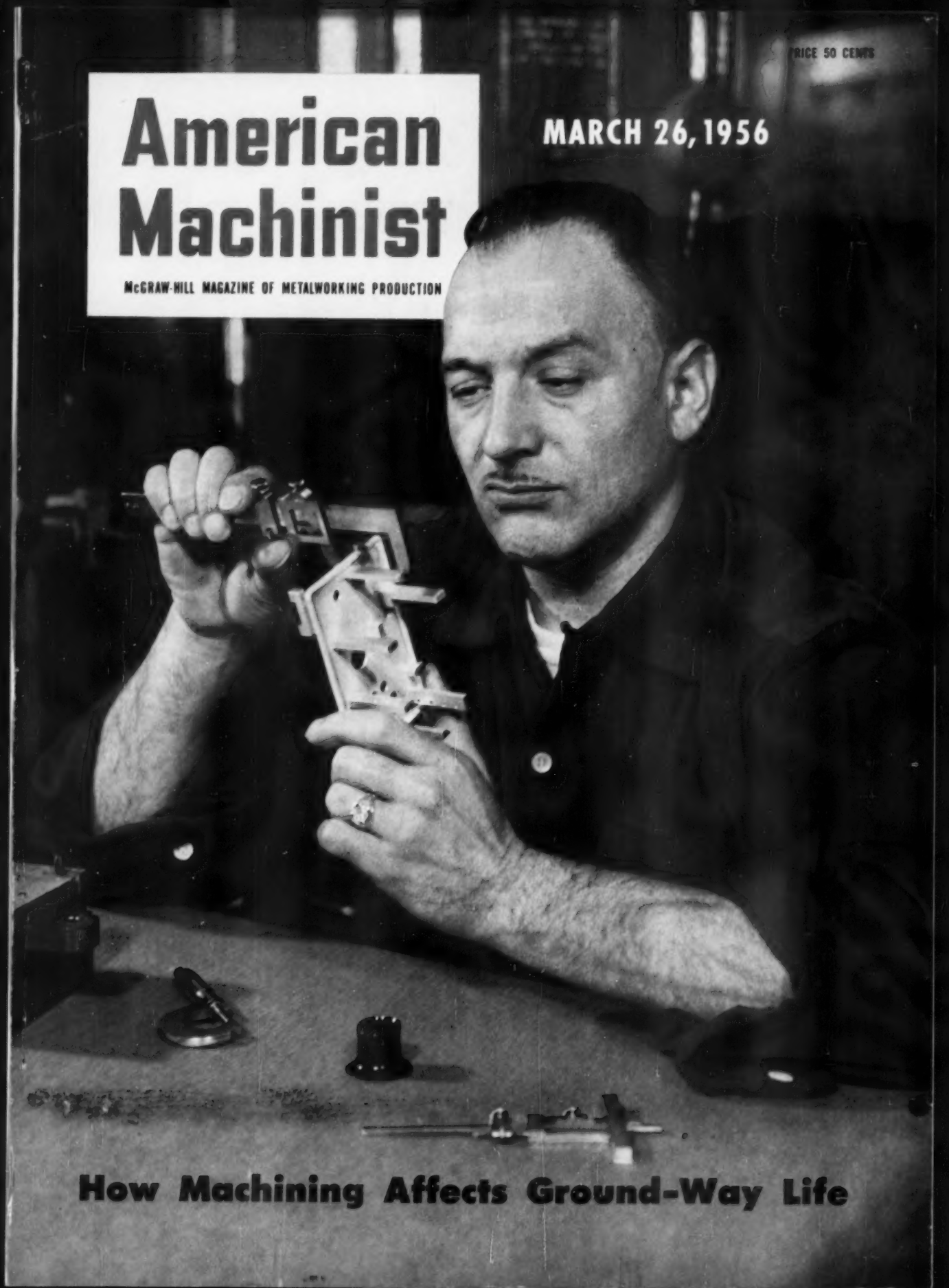
PRICE 50 CENTS
American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
MARCH 26, 1956
How Machining Affects Ground-Way Life

Exit...

ONE SITTING DUCK

A message of importance to all contestants in the battle against high production costs

PIT A World War II plane against a modern jet fighter and what have you got? One sitting duck! Why? Not because the "prop job" got any *slower*. But because the modern supersonic jet got so much *faster!*

So it is with machine tools. The machine you bought ten years ago may still be working just as good as ever. Yet by today's standards of production speed and economy, that same machine can be *losing money* — perhaps more than a new machine would cost.

This "creeping obsolescence" can often go unnoticed—particularly on small-lot and tool room machines that are not geared directly to a fast-moving automated production line. So take a good look at the old universal Bore-Matics, Rotary Surface Grinders, Tool-Room and Plain Internals in your shop. Check their production and maintenance costs. The results may surprise you.

Your Heald sales engineer will be glad to help you evaluate these machines, fairly and squarely — to show you whether they are earning money for you, or losing it. If you find that you're *paying* for a new machine, you might as well *have* it!

IT PAYS TO COME TO HEALD

HEALD

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly, with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder. EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, N.Y. Donald C McGraw, President; Paul Montgomery, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cone, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B Smith, Vice President and Editorial Director; Joseph H Allen, Vice President, Director of Advertising Sales; J E Blackburn Jr, Vice President and Circulation Director.

SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 36, NY. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.

Single copies, 50c. Subscription Rates — United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Other Western Hemisphere and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Second-class mail privileges authorized at New York, N.Y.

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NUMBER OF COPIES PRINTED THIS ISSUE 41,287

chips

BRAIN-BOX MOUNT . . . Quality control is essential following the projection-welding operation on the weldment shown on our cover. Aluminum-alloy plate, 1/16 in. thick, holds 13 posts with a tolerance of ±0.002 in. for position and straightness. It is the mount for a preset precision control box, including precision gearing and electrical assemblies, built by Ford Instrument Co, Div of Sperry-Rand Corp, Long Island City, NY.

MACHINE-TOOL WAYS . . . When one machine-tool builder had trouble with the life of the ground surface on ways, a research program was started that shed light on the influence preliminary machining has on the final ground surface. Results, reported in our current Special Report by Dr Austin (see biography), also point a new approach to surface-finish study.

MULTIPLE DRILLING . . . Two approaches to multiple-drilling operations are described in the first two articles. The lead tells how more than a hundred different hole patterns (10 to 272 holes each) are handled in an efficient automatic way at Western Electric. . . . The second tells how Link Aviation converted a drillpress to drill plastic boards in an automatic setup, holding hole location to 0.002 in. . . . Both will repay study, because putting holes of the right size in the right place is a major problem.

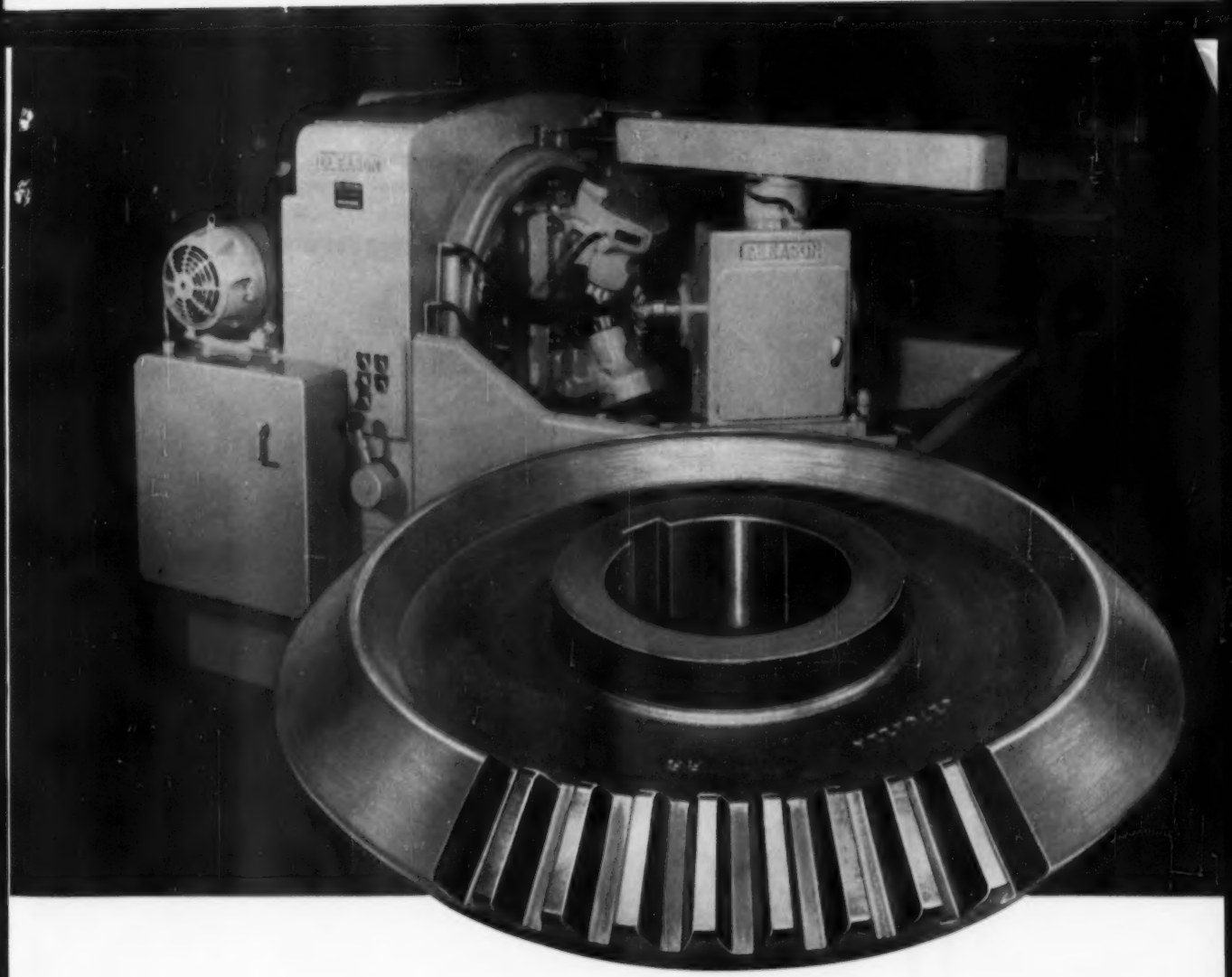
CHIP FORMATION . . . Nothing is more basic to an understanding of metal cutting than a clear understanding of the mechanism of chip formation. As our knowledge of this grows, discussion tends to be more and more involved. Antoni Niedzwiedzki of Firth Sterling provides a simplified discussion of the relationship between work and tool.

BELT GRINDING . . . Feed rates and fixture design for the platen type of belt grinding are covered in the article by John A Simmons, production manager, Engelbert Huller Co. He also offers some ideas on designing a product to take advantage of belt grinding.

CASE STUDIES . . . Production men from six companies compared notes on their experience with contour controls on machine tools at an all-day conference. We summarize the ideas in three pages. . . . Another roundup brings five case studies of vibration in machine tools, showing how sources of vibration were located and eliminated for better cutter life and surface finish.

COMING . . . How do you inspect a telephone? The cover of *AM* for April 9 will show an attractive answer and the issue will contain a 24-page Special Report on the tooling that leads up to that final inspection. The first detailed study of Western Electric production methods ever published, as far as we know, you'll find it packed with tooling ideas. Other features include articles on forging superalloys, hot-chamber magnesium die casting, Step 5 in die design, and our technical report on the ASTE Tool Show, which just ended in Chicago.

DR CHARLES R AUSTIN is assistant to the president and director of research at Mechanite Metal Corp, New Rochelle, NY. He has bachelor's and master's degrees in science technology, doctor's degrees in science and philosophy, and is a Fellow of the Royal Institute of Chemistry. From London's National Physical Laboratory, he went to National Tube Co, Pittsburgh, to head metallurgical research. In 1934, he developed a cooperative research program in metallurgy at Penn State which he directed until he joined Mechanite in 1945.



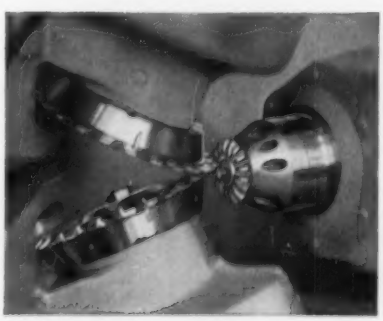
A complete gear for a fifth of a gear!

It all depends on the gear, of course. But, by the time an earlier model generator has cut one-fifth of a gear, the new No. 104 Straight Bevel Coniflex* Generator has *completed* a similar gear!

You can increase your production by as much as 400% with this new Gleason machine. You can get these results because this generator has two interlocking disc-type cutters with twenty-four blades each. These cutters complete a gear in *one rapid operation!*

But that is not all. The No. 104 is easy to set up—it has a wide range of capacity—it is excellent for small quantities or volume production. And, a new generating method insures high efficiency, fine finish, and maximum cutter life.

Write us and we will be pleased to send you a bulletin and further information on the new No. 104 Straight Bevel Coniflex Generator.



The No. 104 Straight Bevel Coniflex Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

*Coniflex® straight bevel gears with localized tooth bearing.

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Builders of bevel gear machinery for over 90 years

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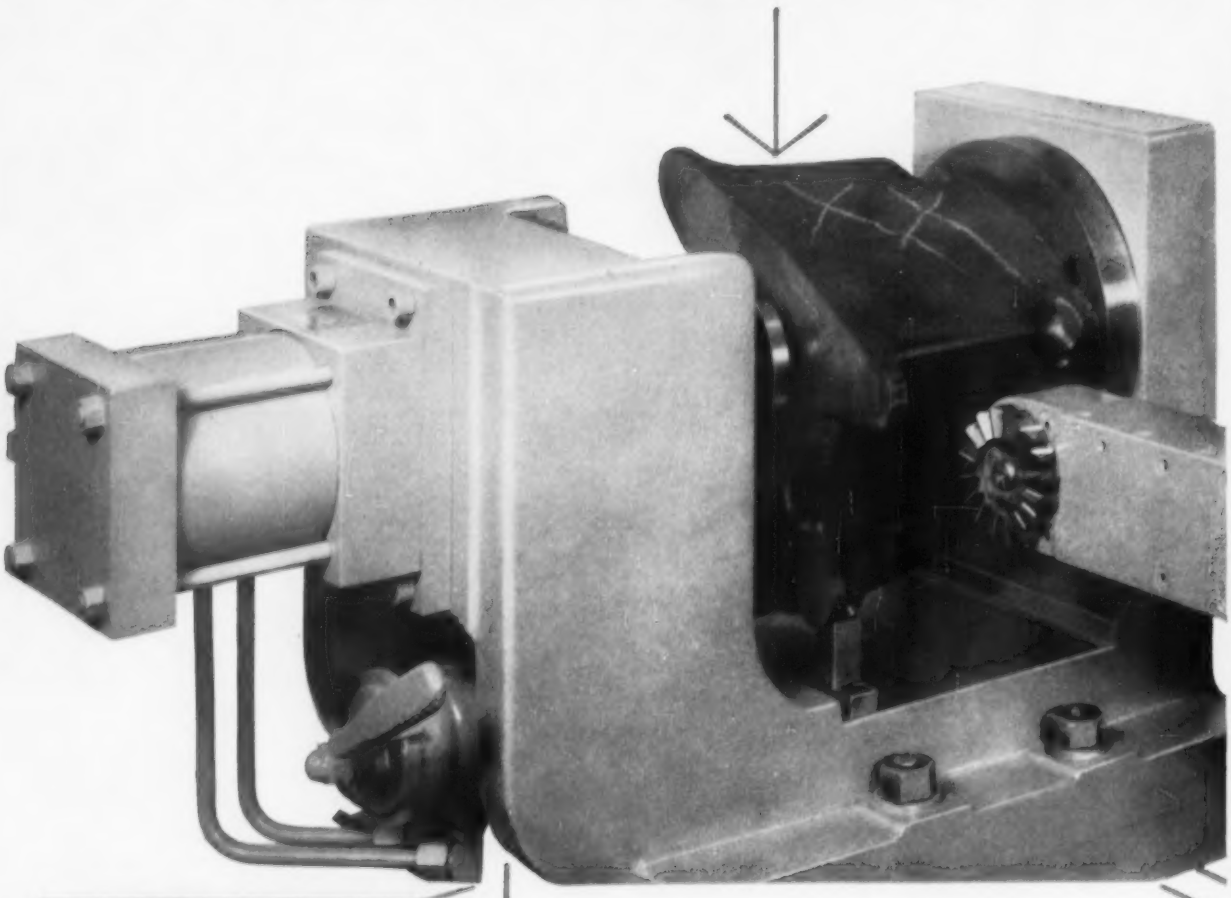
It's An Inside Job

. . . Solved by Cincinnati Engineering and



CINCINNATI No. 1-18 Plain Automatic Milling Machine. Catalog No. M-1555-3.

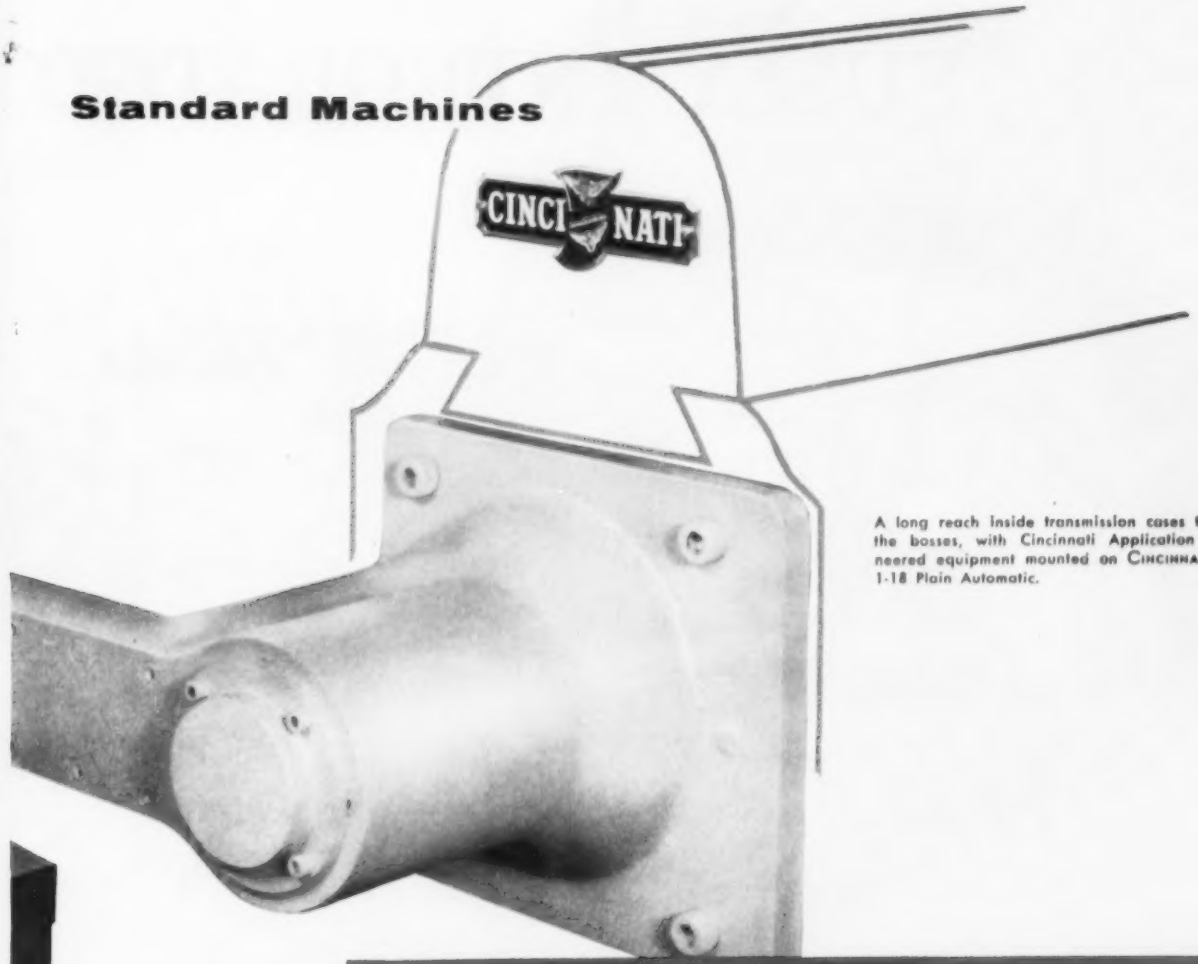
How would you reach deep inside a casting to machine bolt bosses? Cincinnati Application Engineers, long experienced in solving tricky machining operations, tooled up the inside job shown here with a long reach right-angle milling attachment mounted on a standard CINCINNATI® No. 1-18 Plain Automatic Miller. To reduce tiring physical effort, the work is held in an air operated fixture.

The 1-18's fast automatic table cycle, with a feed of 11 in. per min., keeps production going at a rate of about 100 transmission cases per hour.

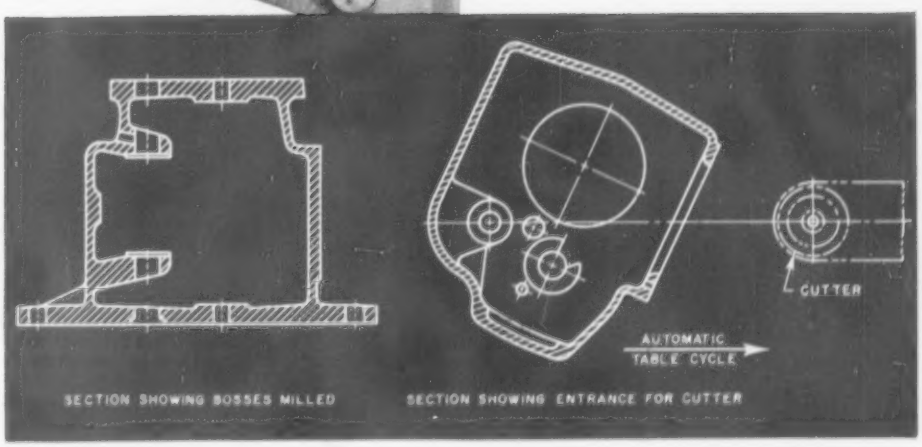
Although this is a rather simple setup, it illustrates what Cincinnati Engineering Service and standard Cincinnati Milling Machines can do for you. ¶ Here's a good point to consider for your next milling machine requisition: standard Cincinnatis range from ½ hp drive to 50 hp drive, and hundreds of sizes in between. You might like to learn more about the production pacemaker shown here, the No. 1-18 Plain Automatic. Ask for catalog No. M-1555-3, or look in Sweet's for brief specifications.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

Standard Machines



A long reach inside transmission cases to mill the bosses, with Cincinnati Application Engineered equipment mounted on CINCINNATI No. 1-18 Plain Automatic.



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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

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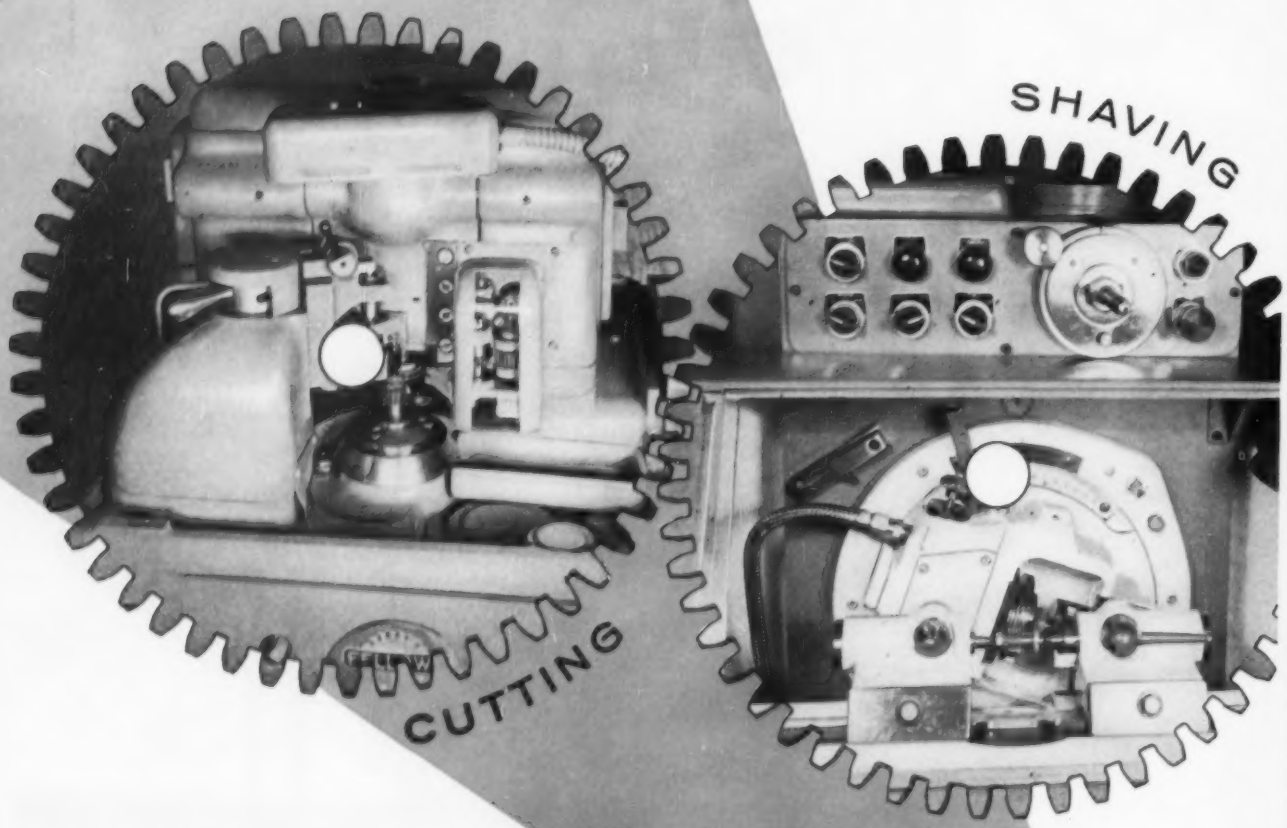

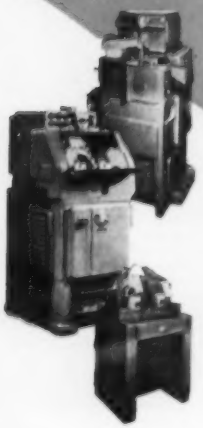

Fellows 3-Inch Gear Shaper will handle work from 1/16" to 3" pitch diameter and as fine as 200 pitch on spur gears. It provides for unusually high speeds... automatic deburring, too.

Fellows No. 4 Gear Shaving Machine provides the fastest possible finishing on spur and helical gears from 1/16" to 4" pitch diameter, 1" face width, 20 diametral pitch and finer. The last word in quality.

Fellows No. 4 Red Liner is especially adapted to the "composite check" of fine-pitch precision gears. Electrical recorder amplifies errors 200, 400 or 800 to 1 and records them on a paper chart. Very fast!

THE PRECISION LINE

PRODUCTION

FOR FINE-PITCH GEARS, TOO

At the NMTB Show, gear men had the opportunity to see for themselves how quantity production of high precision fine-pitch gears can be achieved at low cost. Using a Fellows 3-Inch Gear Shaper, No. 4 Fine-Pitch Gear Shaving Machine and No. 4 Red Liner . . . all fully integrated . . . production speeds can be obtained that a short time ago were considered impractical. Simultaneously, close tolerances can be assured which will meet the most exacting gear-train requirements for electronics and instrumentation.

If you are interested in fine-pitch gears . . . either as a producer or user, or both . . . it will certainly pay you to get all the facts about Fellows line of fully integrated equipment. WRITE, WIRE or PHONE any Fellows Office today!

THE FELLOWS GEAR SHAPER COMPANY.
Head Office and Export Department: 78 River Street, Springfield, Vermont.
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Fellows *Gear Production Equipment*

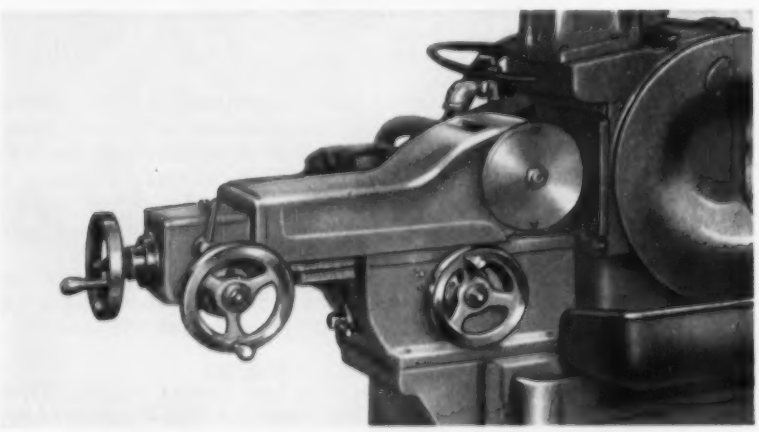
For High Production, Close Tolerance

VAN NORMAN No. 1-C CENTERLESS GRINDER

Actually three machines in one. **(1)** The revolutionary No. 1-C is a standard centerless grinder for thru-feed work . . . **(2)** a standard grinder for infeed jobs . . . **(3)** equipped with the Crush Dressing Attachment, it can grind complicated forms which can be ground no other way. The No. 1-C finish grinds small parts from solid . . . or finish grinds rough-turned parts. It grinds faster, holds closer tolerances, resulting in lower cost per piece.

The No. 1-C is an ideal machine for grinding a great variety of small parts made of metal, plastic, glass, etc. Especially suited for grinding parts used in business and office machines, sewing machines, electrical appliances, aircraft, automobiles, munitions, and similar work. Call, write or wire for full facts, today. See for yourself how this versatile grinder can cut your costs.

EXCLUSIVE CRUSH-DRESSING ATTACHMENT INCREASES SCOPE OF GRINDING OPERATIONS



It crushes the wheel to the desired contour, and holds the form, allowing hundreds of pieces to be ground between wheel dressings, imparting the exact profile to the work.

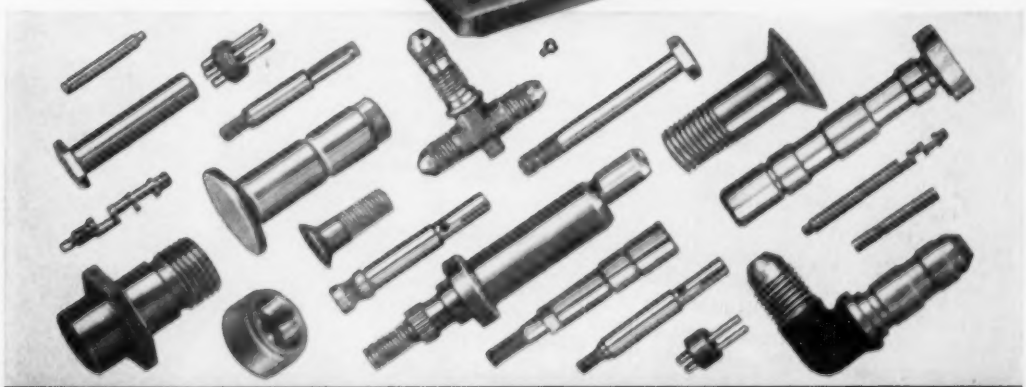
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Grinding of Small Parts...

Only $.79 per hour buys this No. 1-C after minimum down payment on 36 months conditional sales contract.*

Work Size: 0-1½" Diam.
Grinding Wheel: 14" O.D. x 4" wide
Regulating Wheel: 8" O.D. x 4" wide
Automatic cycle optional



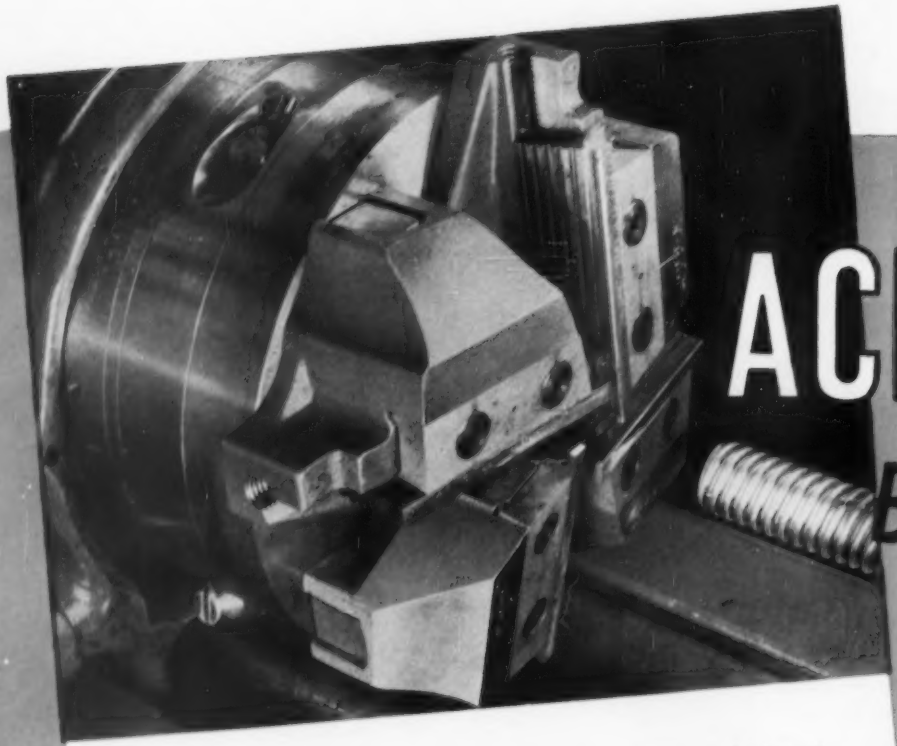
GRIND PARTS LIKE THESE FASTER, MORE ECONOMICALLY . . .

** Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.*

Lease and Conditional Sales Contracts not available to Export.

COMPANY

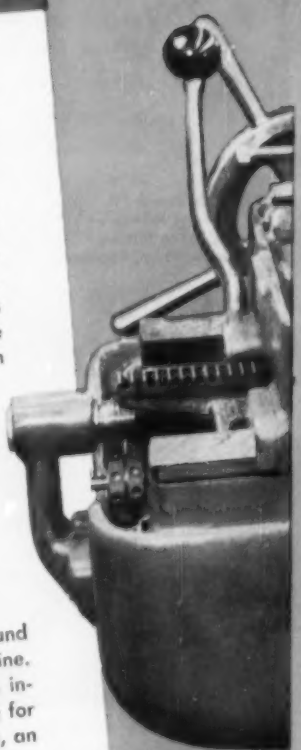
SPRINGFIELD 7, MASSACHUSETTS



ACME Better

A LANDMACO Threading Machine is today playing an important part in the production of top-quality stainless steel valves at The Cooper Alloy Foundry Co. in Hillside, New Jersey.

One operation, illustrated here, involves cutting ¼" pitch ½" lead Acme threads on 1⅝" diameter 304, 316, and 347 stainless steel valve stems. Both thread finish and concentricity are improved over previous threading methods, important factors in meeting the rigid quality standards for "certified" Cooper Alloy valves. IN ADDITION, large production savings are being realized. Each valve stem is threaded with a full 15⅞" thread in 2.5 minutes floor-to-floor time—as against 204 minutes by the previous method. Large savings are also being made in set-up time and in tool cost.



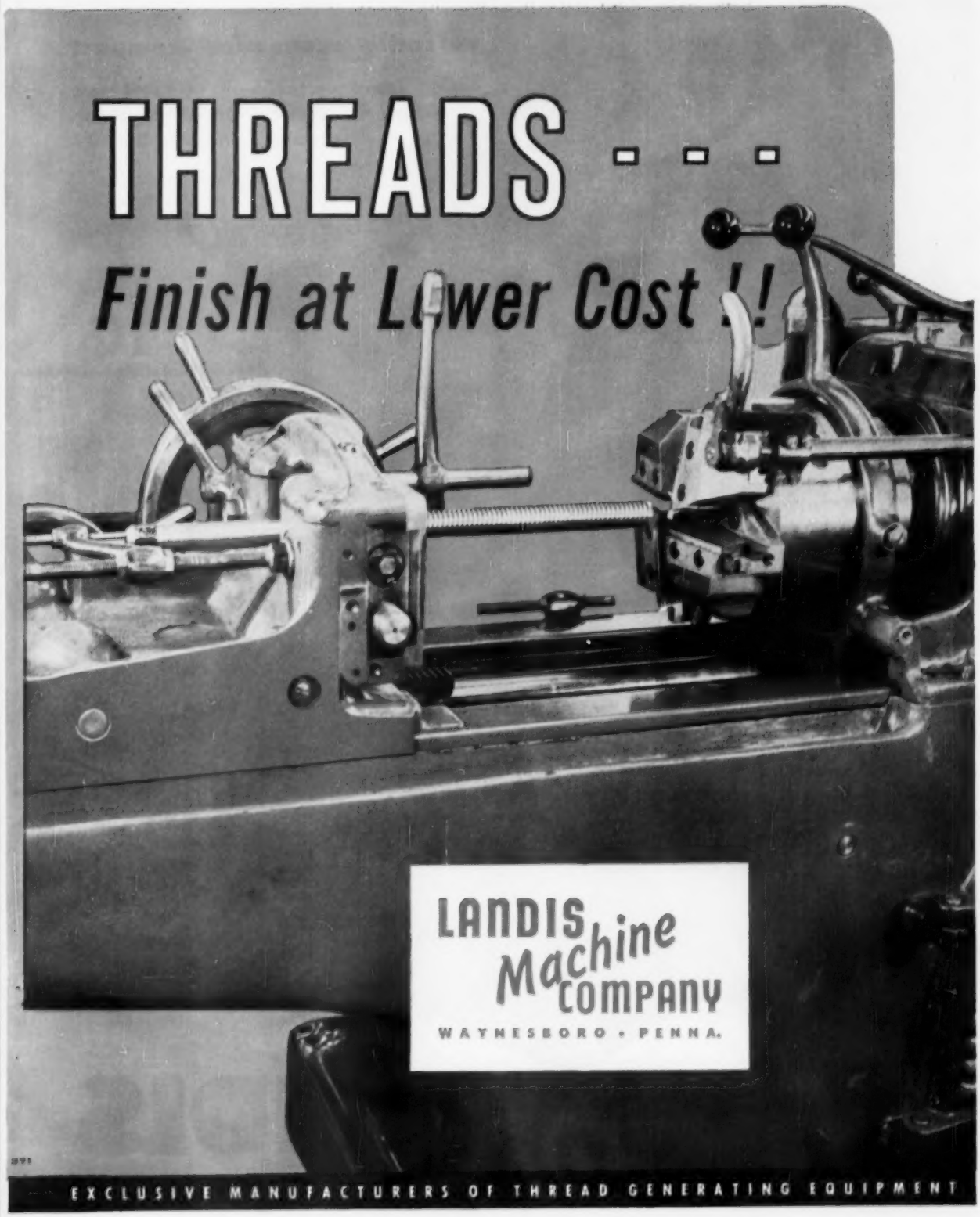
This operation is performed by a 2½" LANDMACO Leadscrew Machine equipped with a 2½" R LANCO Head using roughing and finishing chasers with centering throats. These chasers eliminate the out-of-round condition so common in long workpieces and produce coarse pitch threads of excellent finish in one pass.

Other valve stems, requiring left-hand, right-hand, double-start, and single-start threads, are also produced on this same LANDMACO Machine. These threads range from ⅜" to 1⅝" in diameter, and thread forms include both Acme and U.N. Tool cost is low in all of these operations; for example, when producing a ¾" 6 pitch single Acme thread 5⅛" long, an average of 500 pieces was threaded between chaser grinds.

This case history in just one plant illustrates the possibilities of the LANDMACO Threading Machine in Thread Production—a better quality thread, a lower thread cost, a greater versatility of production. Are there Threading Operations in your plant where these benefits might be realized?

Write for Bulletin H-75.

WORLD'S LARGEST


THREADS - - -
Finish at Lower Cost !!
LANDIS Machine COMPANY
WAYNESBORO • PENNA.
EXCLUSIVE MANUFACTURERS OF THREAD GENERATING EQUIPMENT

Savings in setup and operating time

versatile / economical / compact

Ideal for toolroom or short runs where small parts require precision accuracy and fine finishes

Landis 10" x 20" Universal Cylindrical Grinder

LANDIS

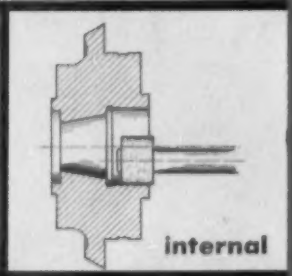
precision grinders

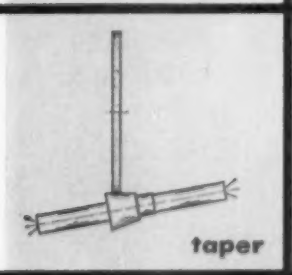
lower grinding costs on small parts

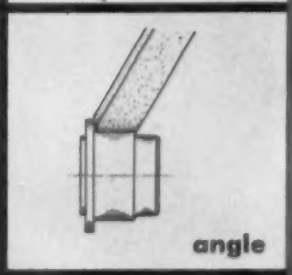
condensed specifications

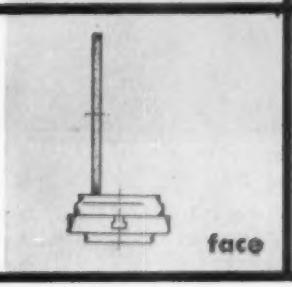
Maximum work swing	10¾"
Length between centers	20"
Diam. standard grinding wheel	10"
Wheel drive motor	1 hp.
Work speed range	90 to 600 r.p.m.
Net weight, including elec. equip.	4100 lbs.

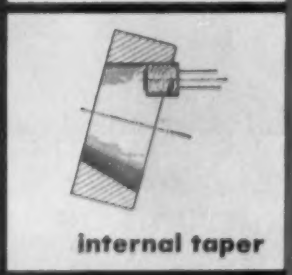
grinding operations on the 10" x 20" universal











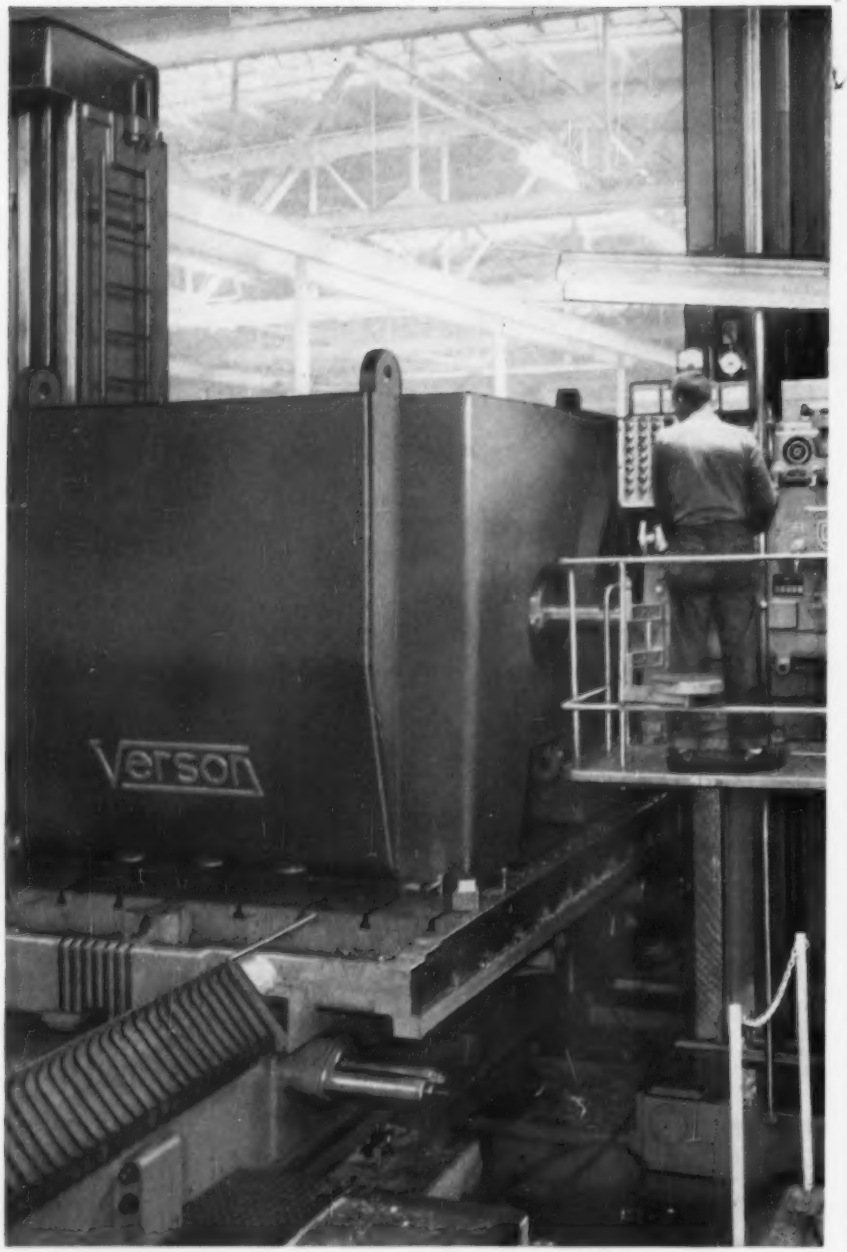
Eye level wheel feed for fast setup and operation

Internal grinding with modern swing-back fixture

Controls grouped for easy setup and operation.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

28½-ton crown for 800-ton VERSON PRESS machined 66% faster on G&L's Planer Type Horizontal



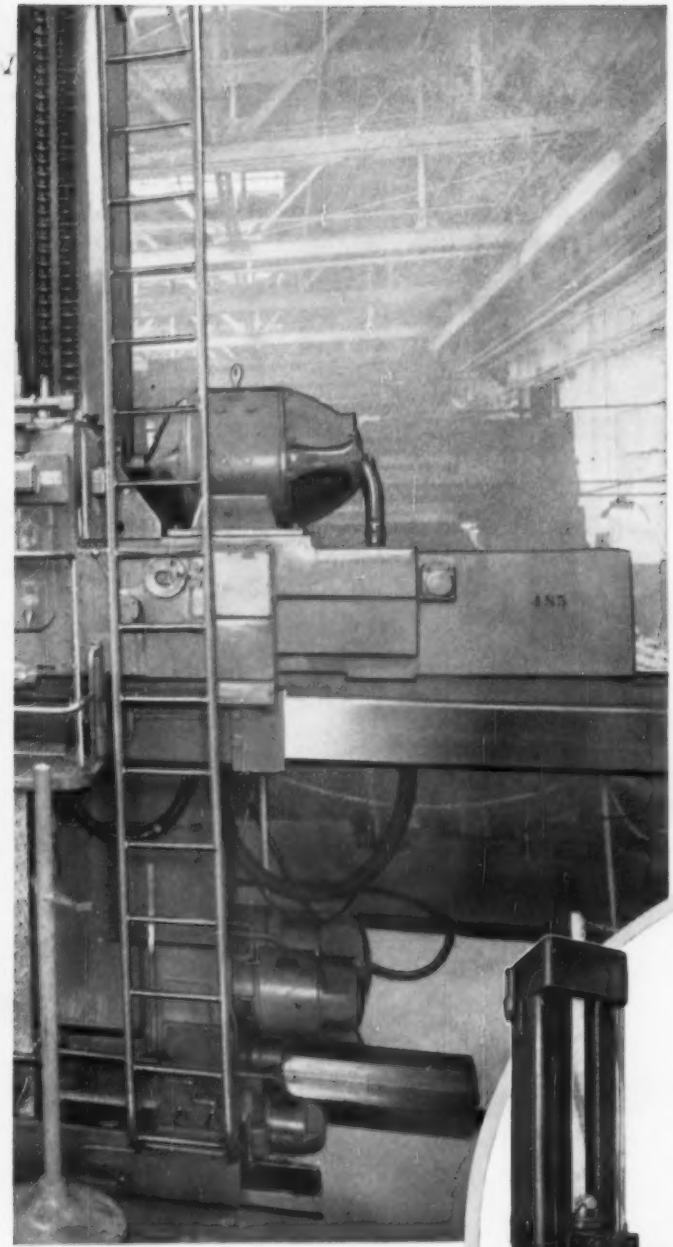
HERE'S an example of large machining operations performed faster and at lower cost on a Giddings & Lewis Model 560-P Planer Type Horizontal Boring, Drilling and Milling machine. And faster production at lower cost is the best reason in the world why you'll find this highly versatile machine at Verson Allsteel Press Co., Chicago, as well as in other leading metalworking plants everywhere.

Here, this dependable, precision-built, two-spindle machine mills, bores and faces a huge 28½-ton welded mild steel press crown — the upper section of an 800-ton mechanical Verson Allsteel press. The crown is 99" high, 115" wide and 145" from front to back. All the machining operations are performed in a record time of 40 hours (including three setups) — 66% faster than ever before.

For complete information on the design and operating features of Planer Type Horizontal Boring, Drilling and Milling machines, see your nearest Giddings & Lewis representative. He'll be glad to give you all the details and tell you what these versatile machines can do for you.

Literature Available

Ask for Catalog No. 50-P with details on 50 Series Planer Type Horizontal Boring, Drilling and Milling Machines.



Giddings & Lewis Planer Type Horizontal Boring, Drilling and Milling machines offer you the features that increase output . . . cut production costs.

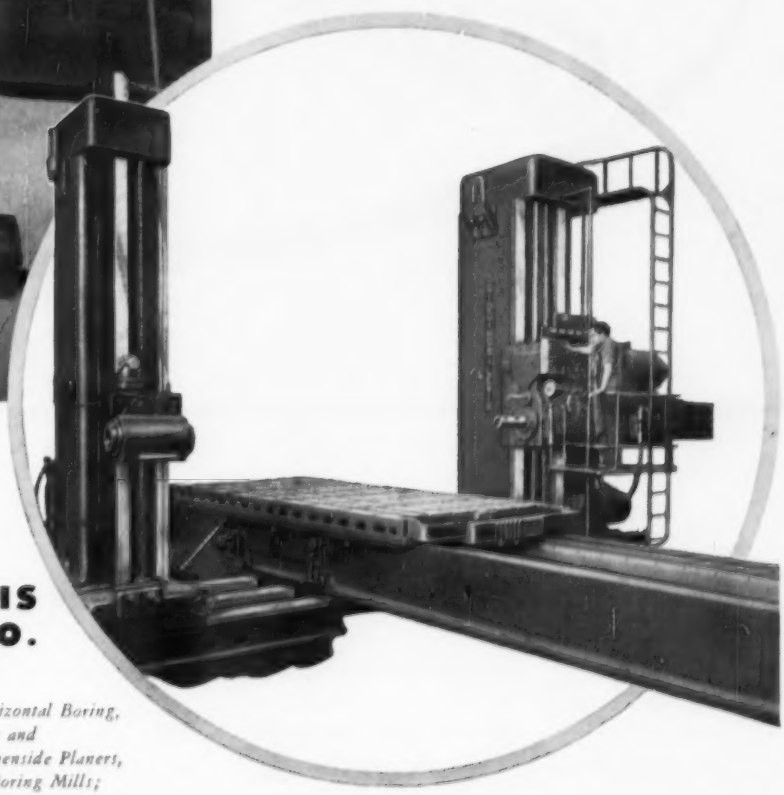
VIBRATION-FREE — Massive, cross-ribbed column, rugged end support, heavy-duty box-type table and balanced headstock design assure vibrationless machining—maintain exacting accuracy at highest speeds under heaviest cutting operations.

DEPENDABLE CONTROLS — Portable and fixed headstock control stations allow full control over all functions within complete working range. Controls are grouped conveniently for easy selection by the operator.

PERFECT LUBRICATION — Motor-driven pumps provide ample lubrication to all bearings . . . pressure lubrication to shifting clutches, the hydraulic clamps of headstock to column and column to runway. Separate pump delivers heavy-duty lubricant to way surfaces.

SAFETY SWITCHES — Electrical safety devices control all movable units of machine — especially for prevention of over-travel by disengaging the feed and rapid traverse whenever extreme limits are reached.

COMPLETE LINE—Planer Type Horizontals are equipped with a wide range of feeds and speeds for main and auxiliary spindles, and heavy-duty spindle underarm support on larger machines. They're available in 10 standard Models and three different Series. Spindle diameters 5" to 14"; motor drives from 40 to 150 hp, 600/1800 rpm; various capacity-increasing optional attachments and accessories.

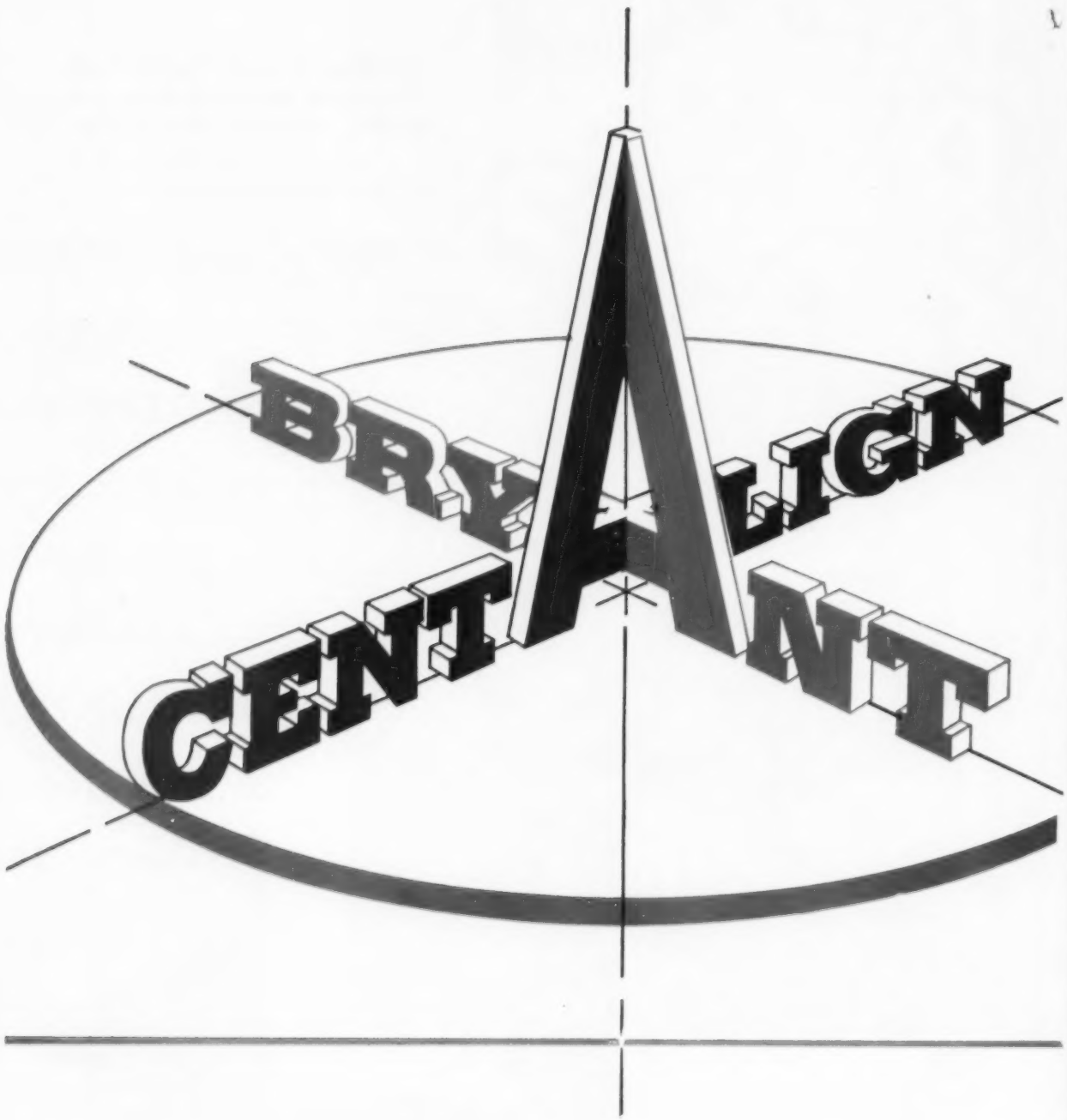


G-57

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools


BRY
ALIGN
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ANT

Symbol...

of the higher production, lower cost internal grinding you've been looking for -

BRYANT CHUCKING GRINDER CO.

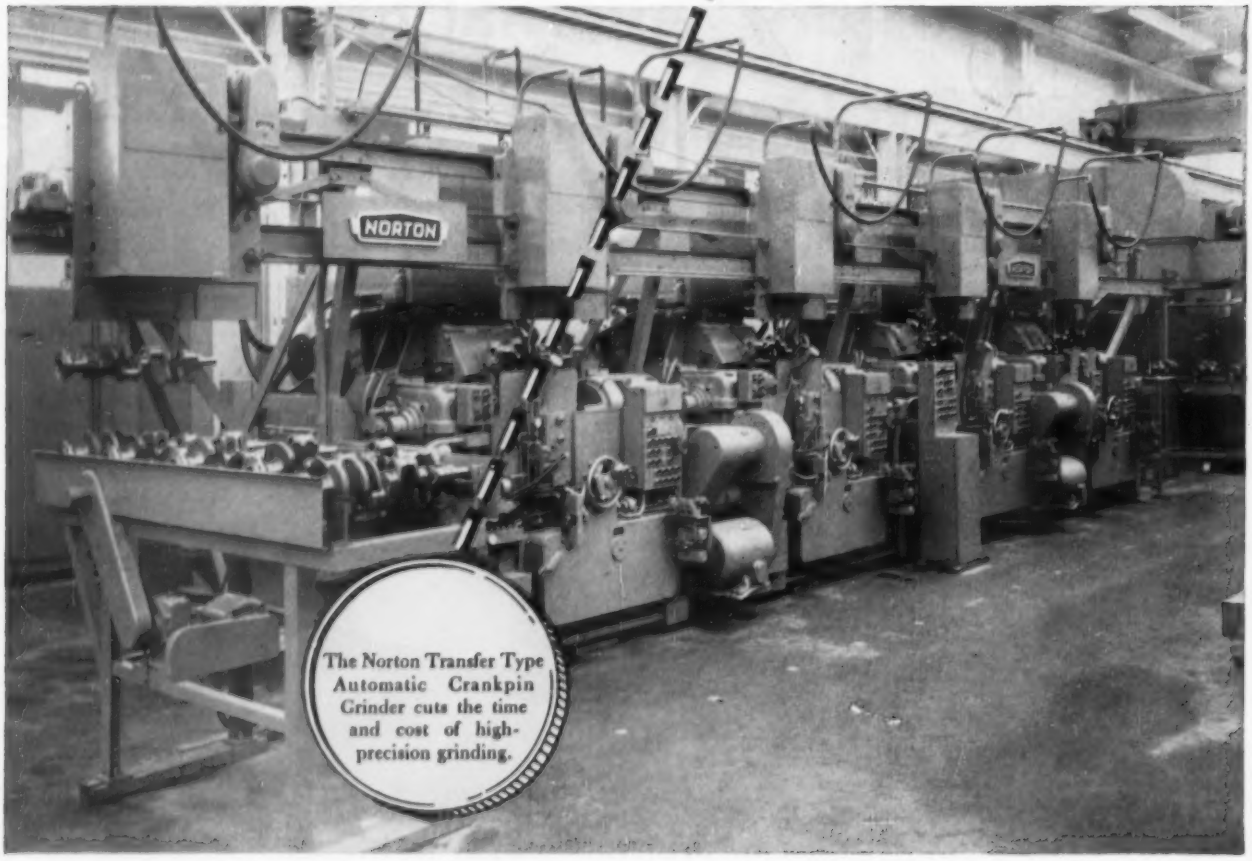
10 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates • Magnetic drum memory devices for computing systems

Norton brings you COMPLETE AUTOMATION IN CRANKPIN GRINDING

Cuts Production Costs



The Norton Transfer Type Automatic Crankpin Grinder cuts the time and cost of high-precision grinding.

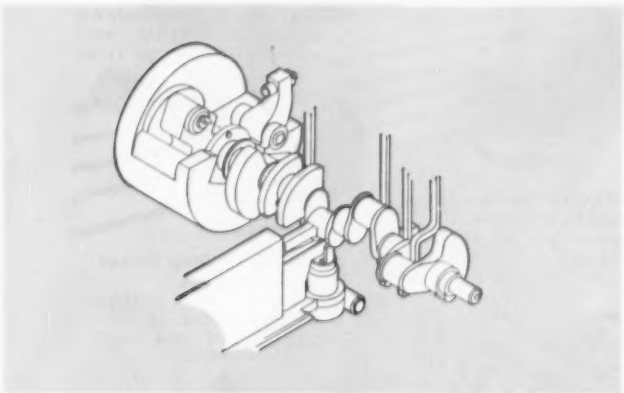
All manual duties now mechanized in this important grinding operation

Now, thanks to the Norton Transfer Type Automatic Crankpin Grinder, the entire operation of crankpin grinding is fully automated. This means you can make worthwhile savings right "across the board" in this complicated, exacting job. For example:

- You save man-hours by doing all *locating, gauging, and transferring* of the work completely automatically.
- You save time and wheel costs by *truing* all wheels simultaneously, automatically, at predetermined intervals.
- You make steady savings by *grinding* entirely automatically. What's equally important, this also enables you to finish all pins on the shaft at a consistently steady rate, day after day.

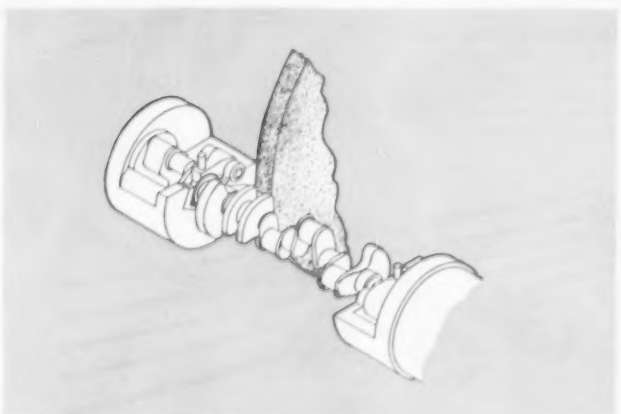
This highly advanced grinder is further evidence of Norton's leadership and progress in the field of automated grinding. A typical Norton "first," it is still another in the long line of equipment designed specifically to help you do a better job, while saving you time, work and money.

4-way automation in new Norton machine



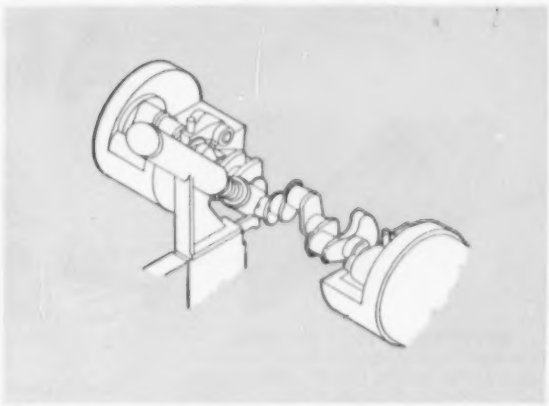
1. It locates automatically

Norton Automation locates the work in the grinder both angularly and longitudinally by built-in mechanism . . . grinding wheels are trued automatically . . . automatic compensation for reduction in wheel diameter is made by the feeding mechanism.



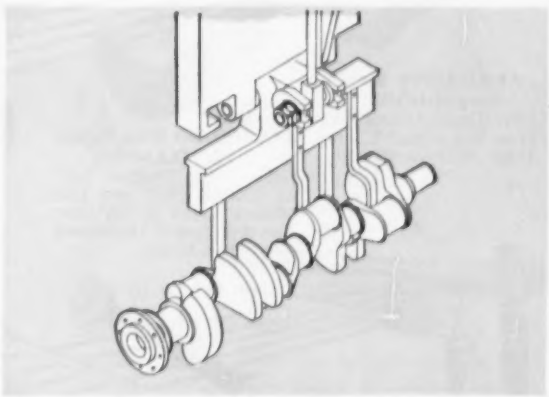
2. It grinds automatically

Being completely automatic, the grinders operate close to 100% efficiency all the working day. They can be pre-set to operate at a definite rate of production continuously. The unit can be controlled, when necessary, to by-pass any inoperative station.



3. It gauges automatically

Spark-out and work size are controlled by an electric gauge which contacts the work during grinding and automatically terminates the cycle by retracting the wheel slide when size is reached.



4. It transfers automatically

Five transfer units travel vertically to pick up and deposit the crankshafts at each station, moving simultaneously. These units are joined together, moving in unison horizontally to transfer the work between stations. The final unit carries ground crankshafts out of transfer machine.

New Automated Grinders Soon to Come . . .

This crankpin grinder is only one of many Norton advances in Automation. For more information about this and other Norton Automated Grinders, write Norton or see your Norton representative. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. For more information, write NORTON COMPANY, Worcester 6, Massachusetts.

To Economize, Modernize with **NEW**

NORTON

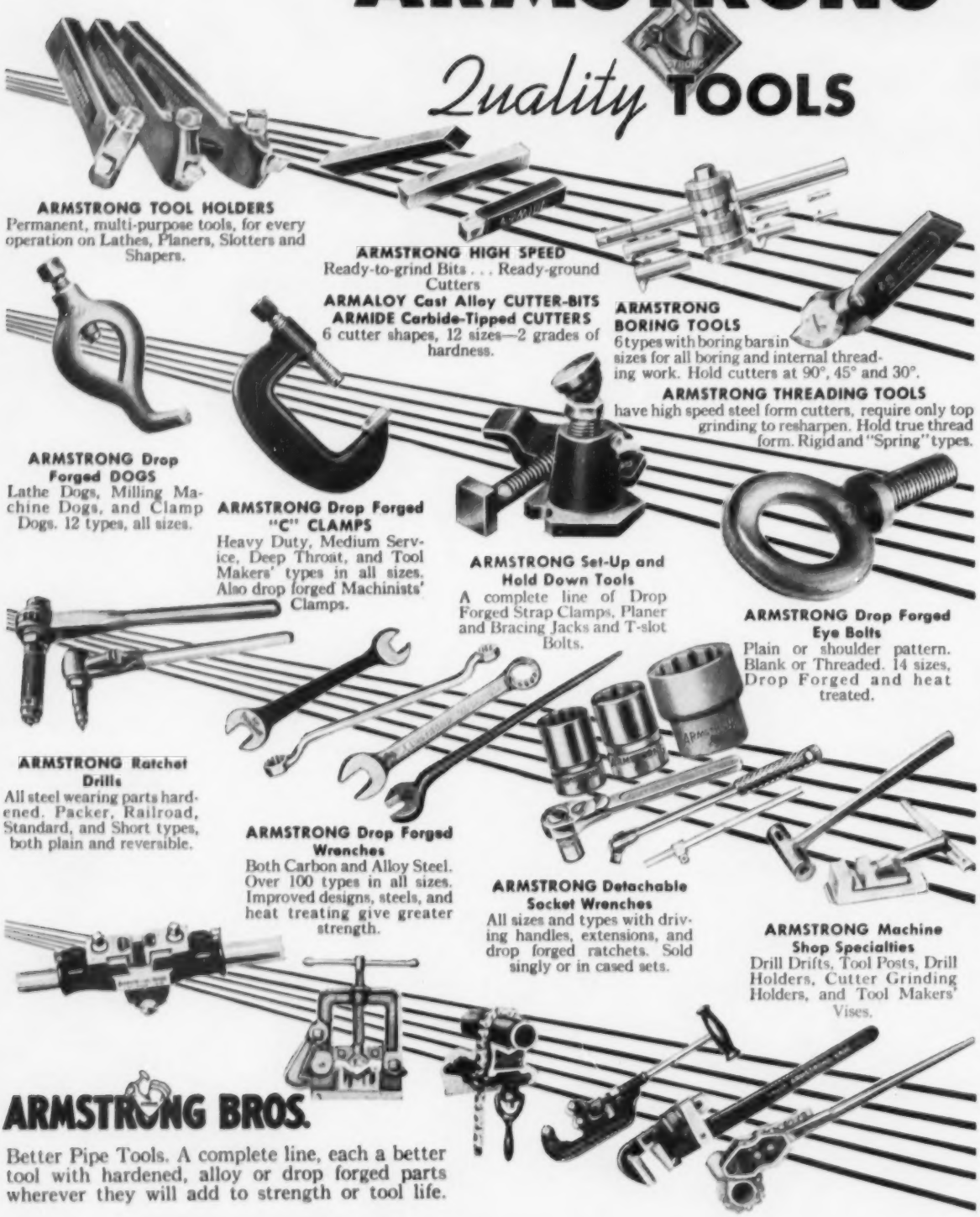
GRINDERS and LAPPERS

Making better products . . to make your products better

District Sales Offices: Worcester • Hartford
New York (Teterboro, N. J.) • Cleveland • Chicago • Detroit

ARMSTRONG

Quality TOOLS



ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits . . . Ready-ground Cutters
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades of hardness.

ARMSTRONG BORING TOOLS
6 types with boring bars in sizes for all boring and internal threading work. Hold cutters at 90°, 45° and 30°.

ARMSTRONG THREADING TOOLS
have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.

ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.

ARMSTRONG Set-Up and Hold Down Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.

ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.

ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.

ARMSTRONG BROS.

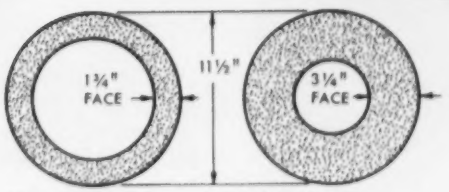
Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

Production per wheel up 36%



FORMER WHEEL
47,405 PIECES

GARDNER WHEEL
65,050 PIECES

use of wider face increases production—cuts abrasive costs.

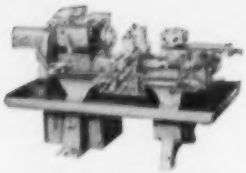
There may be a similar opportunity in your shop to cut abrasive costs. A request gets an analysis of your job.

GARDNER

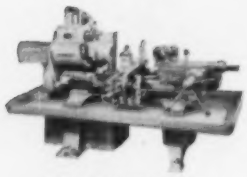
abrasive discs

BELOIT, WISCONSIN

RAM TYPE TURRET LATHES

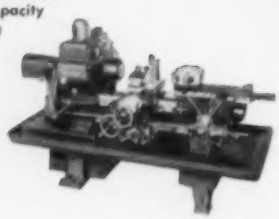


NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing



NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing



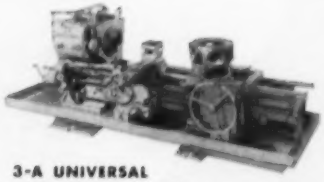
NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing

NO. 4 (M-2240)
2" Bar Capacity
18⅛" Swing

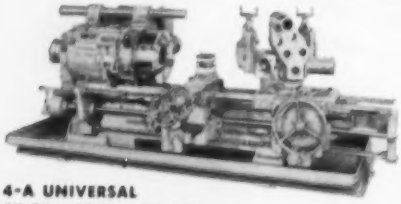
SADDLE TYPE TURRET LATHES
HEAVY DUTY

2-A UNIVERSAL
3½" Bar Capacity
20" Swing

1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing

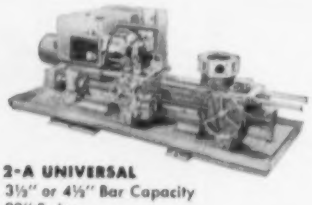


3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing



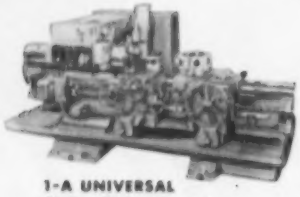
4-A UNIVERSAL
8", 9" or 12" Bar Capacity
28¼" Swing

SADDLE TYPE TURRET LATHES
EXTRA HEAVY DUTY

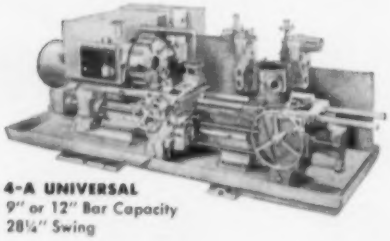


2-A UNIVERSAL
3½" or 4½" Bar Capacity
20" Swing

3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing



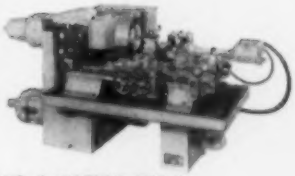
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing



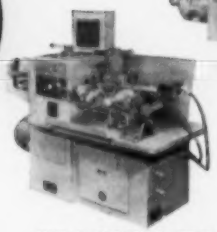
4-A UNIVERSAL
9" or 12" Bar Capacity
28¼" Swing

ELECTRO-CYCLE® TURRET LATHES

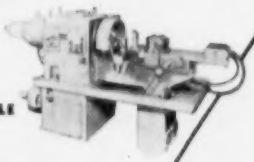
NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing



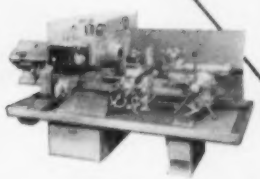
NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing



NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing



16" ELECTRO-CYCLE
1½" Bar Capacity
16⅜" Swing



NO. 5 (M-2250)
2½" Bar Capacity
20" Swing

The most complete line of Turret Lathes in the business!

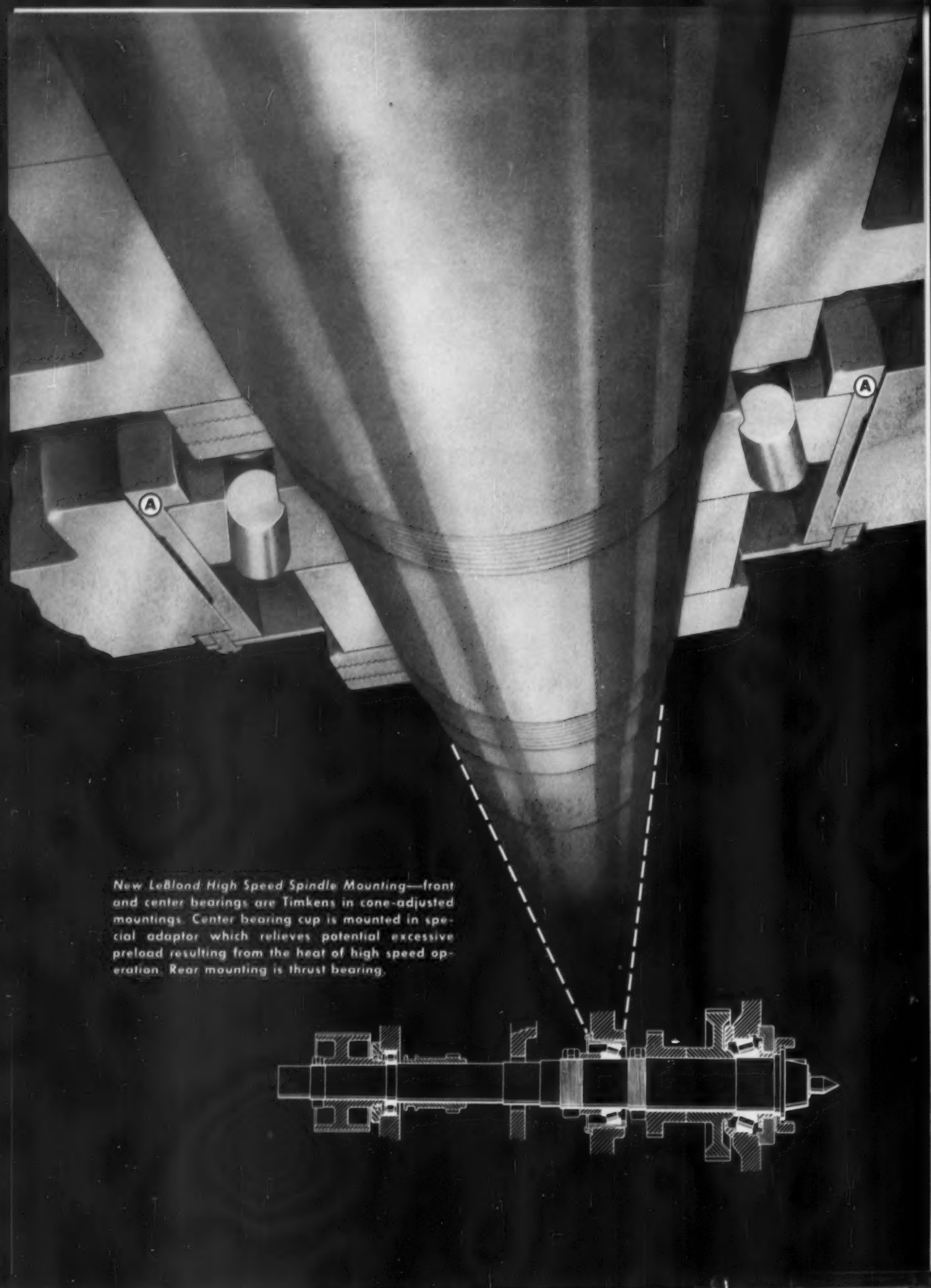
18 DIFFERENT TURRET LATHES

... each individually designed, from the floor up, to most efficiently handle a specific group of work

® Reg. U. S. Pat. Off.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY



New LeBlond High Speed Spindle Mounting—front and center bearings are Timkens in cone-adjusted mountings. Center bearing cup is mounted in special adaptor which relieves potential excessive preload resulting from the heat of high speed operation. Rear mounting is thrust bearing.

before you buy a lathe for high-speed carbide turning... check spindle bearing design

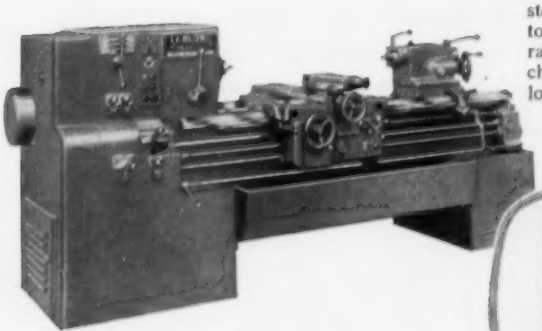
LeBlond construction gives you safe high speeds with long-lived precision. Higher and higher speeds for efficient carbide turning—that's the order of the day in lathe design. But when you talk about 2000 rpm on a 16" H.D. lathe, you've got to think about the new problems created by high speeds.

Heat, generated in a hurry, produces different rates of expansion radially and axially in the bearings and spindle. As a heavy spindle is revved up to 2000 rpm, heat is generated in the bearings. Expansion occurs radially in the bearings and spindle before the heat has time to dissipate and cause a proportionate axial expansion in the spindle. *This is the dangerous interim period!* Unless the bearings can be relieved, excessive preload may cause undue wear and loss of precision. Even failure in the extreme case.

Here's how LeBlond solves this problem. The front Timken bearing is mounted on the spindle and directly in the headstock. The center bearing cup is mounted in an adaptor (A) whose land is .004" smaller in diameter than the headstock bore. The other end of the adaptor is press fitted. As the bearing temperatures rise in operation, the center bearing and adaptor expand radially into the slight clearance. Both front and center bearings are thus relieved from extreme preload—failures due to excessive tightness and wear are eliminated. The original factory-set preload can handle both high and low speeds—no need to reset bearing adjustments in the field.

This is typical of the under-the-surface quality engineered into every detail of LeBlond Lathes. To give you the operating speeds you need, with the safety, precision and long life you expect when you purchase a LeBlond.

Whatever your turning needs, high speed, high horsepower or high production, LeBlond has a lathe in its complete line to do the job. 76 different models to choose from. See your LeBlond Distributor or write today.



Other important features of the new LeBlond 16" Heavy Duty Lathe include combination gear-belt drive headstock, 18 geared speeds, 9 timing-belt-driven speeds up to 2000 rpm, free running spur gear design, four-way rapid traverse, one-piece apron, totally-enclosed quick-change box, hardened and ground steel bedways, thrust-lock tailstock. Ask for Bulletin HD-126A.

. . . cut with confidence

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY • CINCINNATI 8, OHIO

World's Largest Builder of a Complete Line of Lathes • for more than 69 years

It's easy to recognize the PRODUCTION VERSATILITY

of this LAPOINTE electro-motive drive

As shown in these photographs, this double ram machine is broaching stator wheels on the left side and mating blades on the right. Here's balanced production!

However, it could be set up for broaching *all wheels, or all blades — or other comparable parts.* With Lapointe-built broaching fixtures, you can quickly make a change-over to suit your production requirements of the moment.

And we do mean production, for this 40 hp., 100-inch stroke machine broaches at rocket-like speeds up to 300 feet-per-minute! Built for operating right around the clock, 24 hours a day, this heavy duty Lapointe Broaching Machine with electro-motive drive was purposely engineered for mass production.

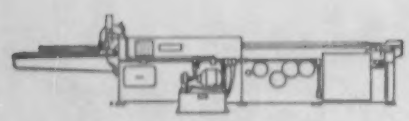
Any questions? We probably have the answers . . . we've been building broaching equipment exclusively for 54 years — longer than anybody else!

THE LAPOINTE MACHINE TOOL COMPANY

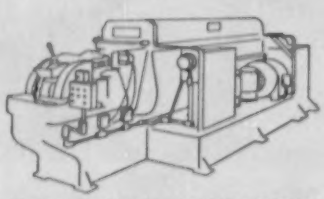
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

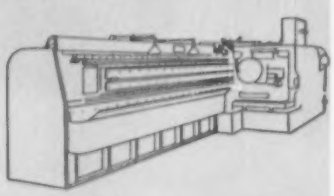
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC

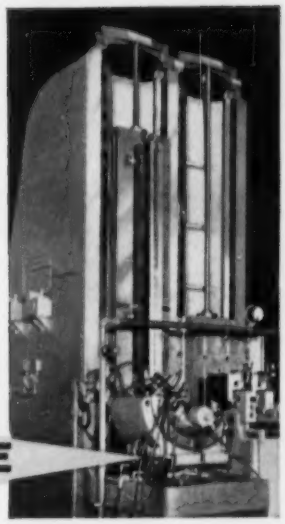


CH CONTINUOUS BROACHING, ELECTRIC



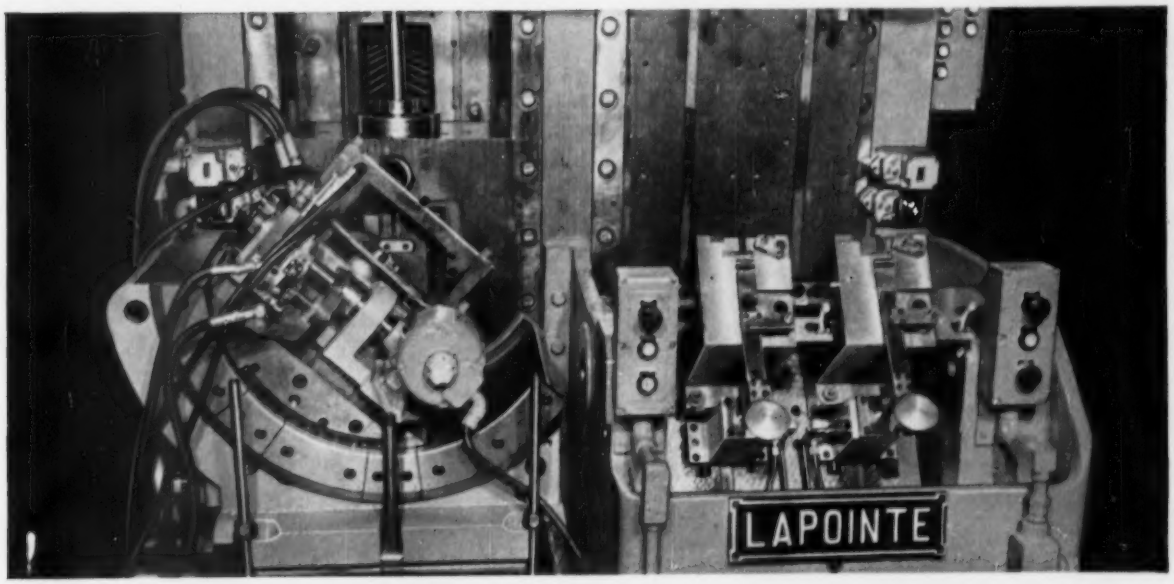
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

BROACHING MACHINE

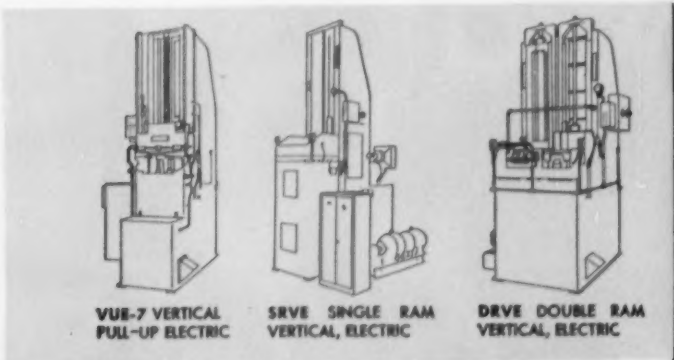


This machine weighs 68,000 pounds. A comparable machine with hydraulic drive weighs only 38,000 pounds. Weight is a most important factor in a broaching machine built for electro-motive drive, as Lapointe has learned through years of pioneering experience in developing electro-mechanical broaching machines.

LAPOINTE takes all the responsibility, for your broaching program — we build the broaching *machines,* build the broaching *fixtures,* and make the *broaches!*



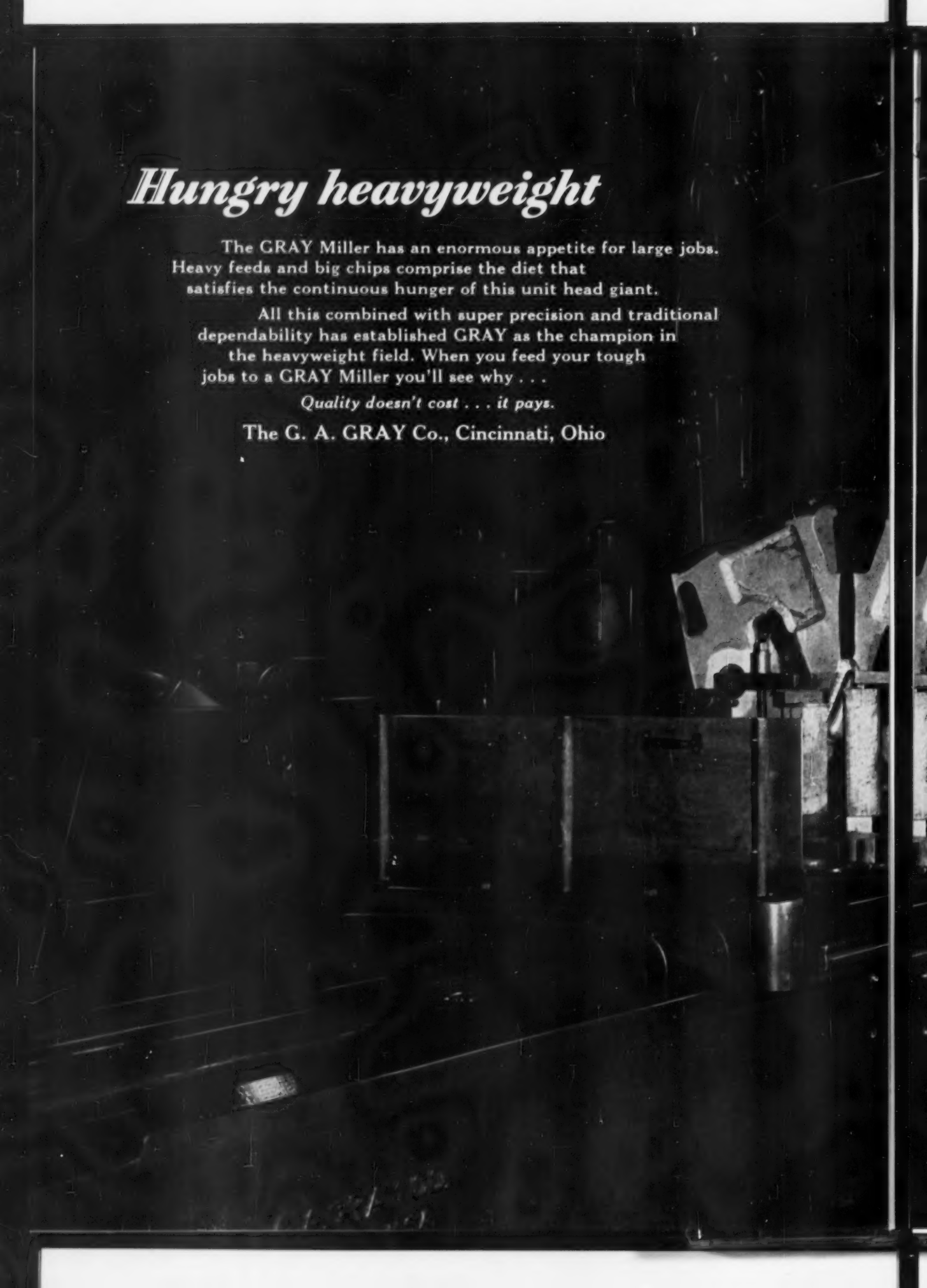
Fixture on the right ram is the patented Lapointe Tip-Down type. The universal fixture on the left ram can be set from 0° to 45° rotatively, and 0° to 30° conically, enabling parts to be processed at a compound angle. Here, it is broaching stator wheel slots . . . 76 of them, equally spaced within .005" of true position.



VUE-7 VERTICAL PULL-UP ELECTRIC | **SRVE SINGLE RAM VERTICAL, ELECTRIC** | **DRVE DOUBLE RAM VERTICAL, ELECTRIC**

LAPOINTE

BROACHING MACHINES


Hungry heavyweight
The GRAY Miller has an enormous appetite for large jobs. Heavy feeds and big chips comprise the diet that satisfies the continuous hunger of this unit head giant.
All this combined with super precision and traditional dependability has established GRAY as the champion in the heavyweight field. When you feed your tough jobs to a GRAY Miller you'll see why . . .
Quality doesn't cost . . . it pays.
The G. A. GRAY Co., Cincinnati, Ohio

GRAY

the finest heavy duty gap lathes

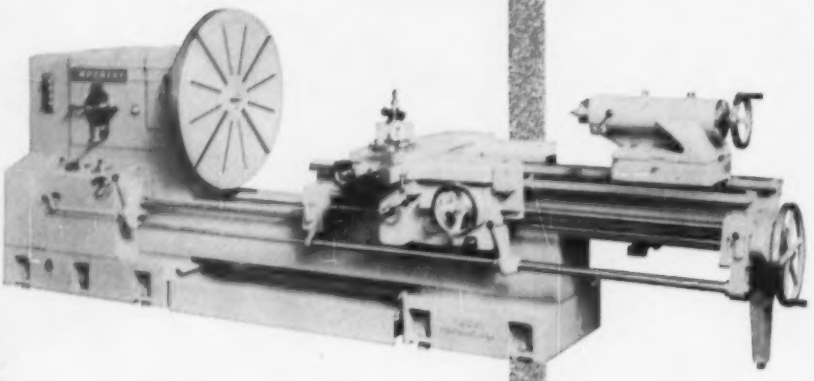
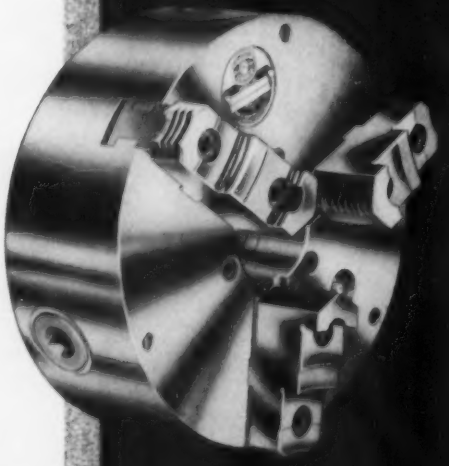


Photo Courtesy
Nebel Machine Tool Corp.

This is Nebel's new Imperial 20"/40" extension bed gap lathe which features 18 spindle speeds from 11 to 666 rpm and a capacity of 24½" swing over the ways and 42" over the gap. Easy, positive operation is assured by direct reading speed selector controls and color coded speed plates. For complete details on this outstanding lathe write the Nebel Machine Tool Corp., Cincinnati 25, Ohio.

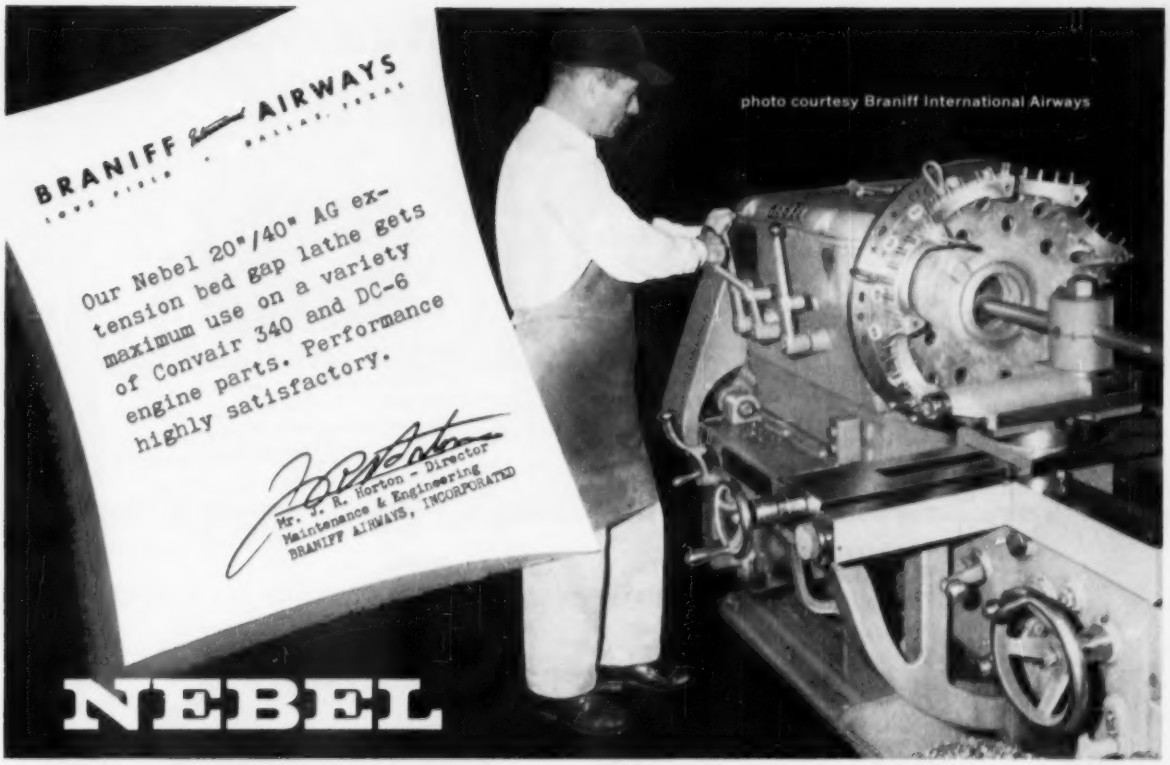
deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.

HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.


BRANIFF AIRWAYS
Our Nebel 20"/40" AG extension bed gap lathe gets maximum use on a variety of Convair 340 and DC-6 engine parts. Performance highly satisfactory.
Mr. J. R. Horton - Director
Maintenance & Engineering
BRANIFF AIRWAYS, INCORPORATED
photo courtesy Braniff International Airways
NEBEL

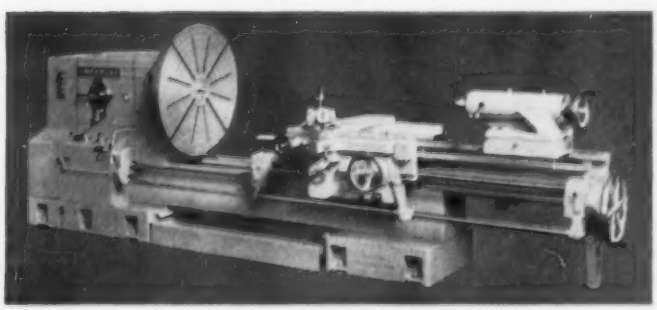
gap lathes perfect for aviation machine shops

Aircraft manufacturers and operators are finding Nebel extension bed gap lathes the most useful tools in the machine shop. The sliding upper bed opens up a wide, deep gap that accommodates outsize, odd-shaped parts like the R-2800 engine case shown above. And with the gap closed, the lathe will turn all your standard engine lathe work as well.

This double duty gap lathe/engine lathe feature means low capital investment, efficient use of floor space. It has earned Nebel extension bed gap lathes a warm welcome throughout the aviation industry . . . including jet engine production and airline maintenance.

Your own company can benefit enormously from the capacity, speed, power and performance these productive lathes offer. Made in three different models and many sizes (see below), there's a Nebel gap lathe that will fit your requirements exactly.

Nebel also manufactures removable block gap lathes, 16"/27", 20"/30" and 25"/40" swing sizes; and engine lathes 16" to 36". For complete information, send today for descriptive bulletins. Nebel Machine Tool Corp., Cincinnati 25, Ohio.



Nebel LATHES CINCINNATI

Nebel Extension Bed Gap Lathes

Nebel offers a complete range of models and bed lengths. You're sure to get exactly the type and size you need.

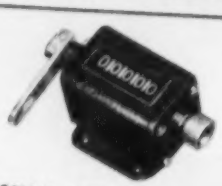
Condensed specifications

	Swing over ways	Swing thru gap	Width of gap*	Bed length† Minimum	Bed length† Maximum	Spindle speeds range, rpm	Motor Recommended
Imperial 20"/40"	24½"	42"	32"	8 ft.	30 ft.	11-666 or 16-1000	15-20
AG series 20"/40"	22½"	40"	24"	6 ft.	20 ft.	9-280 or 16-500	7½-10
G series 28"/50"	29"	52"	41"	10 ft.	30 ft.	5-230 or 10-460	20-25

*on shortest bed length

†increasing in increments of 2 ft.

Here's THE basic V-R "COUNTER-PACKAGE" for INDUSTRY...

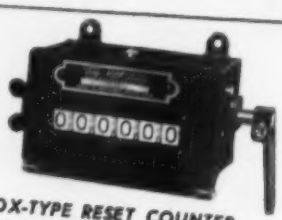


SMALL RESET COUNTER

A compact, rugged reset counter for moderate duty in parts inspection, quality control, conveyors, machine tools, light presses, etc.

Dimensions: 1¾" long, 1 13/64" high, 1 1/16" wide

Speed: Up to 1000 counts per minute.



BOX-TYPE RESET COUNTER

For punch press installations, conveyors, metal-working equipment, die casting, plastic-molding, rivet, spring and wire machining, or any installation requiring a heavy duty counter.

Dimensions: 4¼" long, 2 21/32" high, 3⅝" wide.
Speed: 500 counts per minute.

RESET MAGNETIC COUNTER

For remote indication of machine operation from plant to office.

Dimensions: 3 15/16" long, 2½" high, 1⅝" wide.

Speed: Up to 1000 counts per minute.

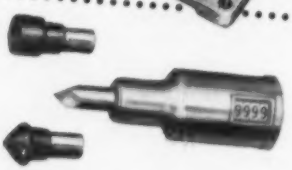
Coils: 110V-AC are standard. Other voltages are available. Panel mounting feature also available.

HAND TALLY

For quick spot-checks of production or performance.

Dimensions: 1 11/64" long (to end of reset knob), 1¾" deep, 2" high.

Counts one for each depression of the thumb lever, and resets to zero by a turn of the knob.



CLUTCH SPEED COUNTER

For checking to make sure that the machine is operating at the required R.P.M.

Dimensions: 3¼" long, ⅜" max. diameter. Non-Reset.

Internal clutch operates counter only when rubber tip is pressed against the shaft.

Here are 5 of the most widely used Veeder-Root Counters in industry . . . and they're immediately available from stock at leading Industrial Supply Distributors. There are Veeder-Root mechanical, electrical and manual counters for use in production recording and control, wage payment, time study work, quality control. In fact, you can profitably apply Veeder-Root Counters to every machine, operation, process or system in your plant. Ask your own Industrial Supply Distributor. Or write Veeder-Root Inc., Hartford 2, Conn.

Everyone can count on

VEEDER-ROOT

'The Name that Counts'

Insist on Standard

VEEDER-ROOT COUNTERS

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or write us on special problems

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

PRE-SET TOOLS IN MAGAZINE-TYPE TOOL BLOCKS SPEED CHANGE-OVER

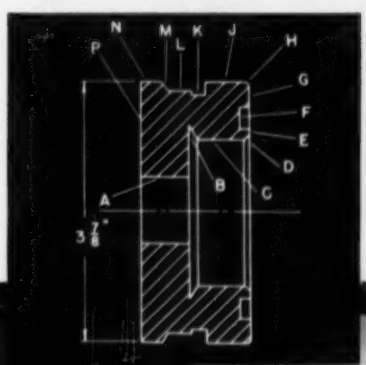
Six Different Part Sizes Handled with Minimum Tool Setting Required

Here is a business-like setup, for producing various sizes of neck ring molds from 17″ long cored cast iron billets. The billets have been rough turned and cut in half prior to this machining operation.

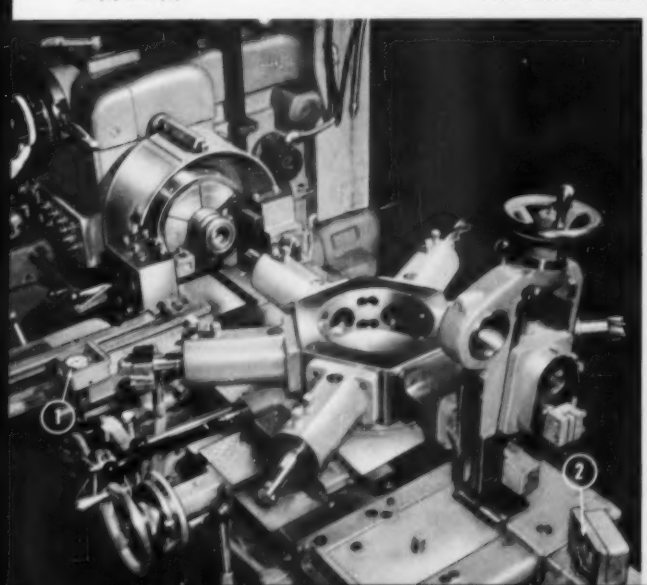
This setup is on a 3⅞″ diameter neck ring mold. Surfaces A-B-C-D-F-J-N are machined from the hexagon turret. Critical lengths are easily held, using a "tenth" indicator on the turret saddle. Surfaces E-G-H-K-L-M are handled from the front of the bridge-type cross slide, with multiple tools held in a longitudinally adjustable magazine-type tool block. The tools are hand fed to depth with close dimensions checked by a second "tenth" indicator. Cut-off is at P from the rear of the cross slide. Floor-to-floor time is 10.3 minutes.

The spindle on this sturdy Gisholt 1L Saddle Type Turret Lathe has a special 7″ pilot bore, for a depth of 18″ and a 15″ spindle nose. Thus the work is rigidly supported, back in the spindle, while machining is performed. A special collet chuck is used, with an air-operated pusher arrangement to feed the stock and an air blast in the bore to clear the jaws of chips before each new billet is inserted. A six-section master collet provides the necessary flexibility for chucking the six part sizes.

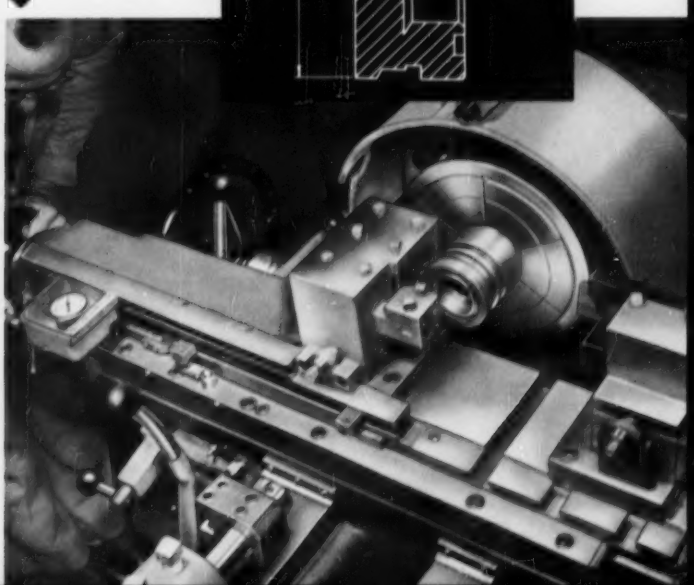
Tools in magazine-type tool blocks are ground and pre-set to gauge in tool room to cut downtime. Tolerances are checked with dial indicators. Special spindle bore saves cost of larger capacity machine.



Pre-set tools in magazine-type tool block are hand fed to depth as dial indicator provides visual tolerance check.



Finished part being cut off from rear of bridge-type cross slide. Note "tenth" indicators mounted at (1) and (2).



MASTERLINE GISHOLT SINCE 1887

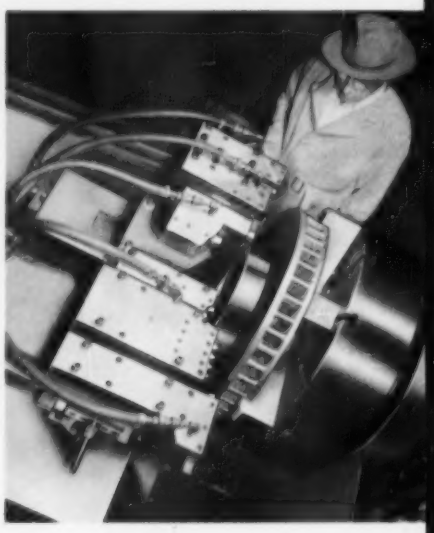
TIME-SAVING IDEAS

14 TOOLS MACHINE 11 SURFACES IN ONE OPERATION

Features Table Feed and Two-Speed Motor Arrangements

This job is tailor-made for the rugged Gisholt Simplimatic Automatic Lathe. Tooling is planned for fast change-over, since machining operations on both sides of these 28" diameter, 6½" wide cast iron rotors are handled.

The second operation is shown. After chucking, the extra-wide platen table traverses the tooling to the work, and then changes to feed as the flange O.D. is turned with the tool at the rear while the facing tools on the rear slide are plunged to depth. Then, the rear slide feeds transversely with four tools dividing the rough cut across the flange face as others face and co-bore the hub I.D. At the same time, the center slide feeds forward to finish size and relieve the hub co-bore, bore the flange I.D. and round the hub and flange edges. As the rear slide tools complete the rough facing cut, the front slide trips the two-speed motor to the "high" side. A single tool finish faces the flange and another rounds the O.D. edge, completing the part. Floor-to-floor time on this job is just 13.8 minutes.



Platen table provides maximum support with minimum overhang to eliminate vibration and improve accuracy. Two-speed motor arrangement on the Simplimatic provides a finer finish, both on the flange face and in the hub co-bore.

Extra-wide platen table carries 3 tool slides. Fourteen tools machine a maximum number of surfaces in one operation.

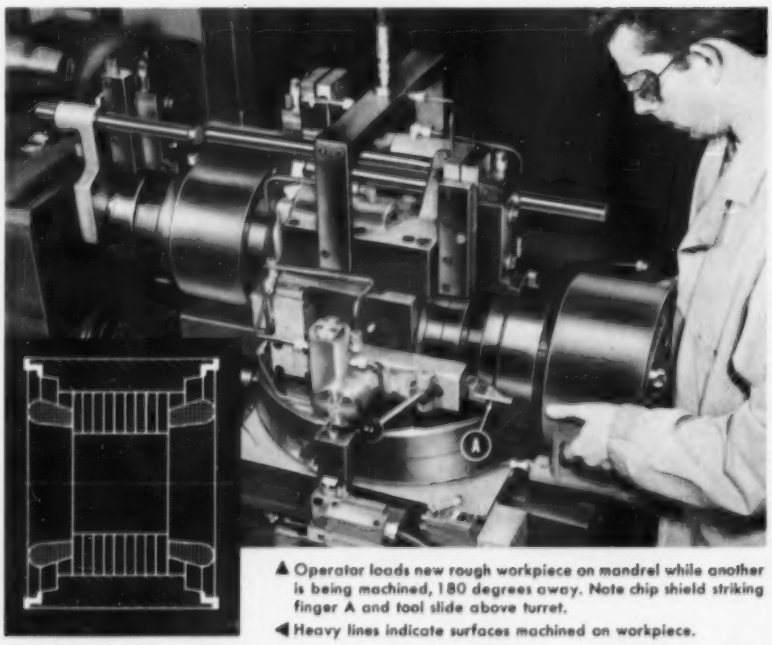
THIS SETUP WHIPS UNPRODUCTIVE TIME

Chips Fly as Operator Loads and Unloads Parts

Here's how rabbet fits on three basic sizes of cast iron electric motor frames are handled at a rate of 120 parts per hour. The machine is a Gisholt No. 12 Automatic Production Lathe, equipped with twin arbors on a special carriage-mounted indexing turret. The operator simply loads and unloads while machining is performed, incorporating former unproductive time into the machining cycle.

The motor frames arrive with windings already in place and the rabbet fits rough machined. The rabbet fit bores range from 8⅜" to 9$^{23}/_{32}$" in diameter. Expanding mandrels hold in stator bores ranging from 3¼" to 6⅞" in diameter. The depth of cut is the same on all parts, so the floor-to-floor time is set at 27 seconds.

Here's the cycle: operator removes finished part and places new workpiece on mandrel. Location is against chip shield striking finger (A) actuating switch, allowing arbor to expand chucking part in I.D. Finger A is retracted, clearing indexing circuit. When part is completed, carriage trips into reverse traverse and, when fully back, indexes 180 degrees and unchucks finished part. Carriage traverses forward, changing to feed as mating teeth on mandrel and spindle flange engage to drive work. Spindle starts. Continued forward feed of carriage engages overhead pusher rod with dead stop actuating tool slide over turret. Slide on turret feeds tool forward as carriage feed moves work into tool mounted over spindle, simultaneously machining the rabbet fits at both ends. As part is completed tools are relieved, carriage trips into reverse traverse and cycle repeats.



▲ Operator loads new rough workpiece on mandrel while another is being machined, 180 degrees away. Note chip shield striking finger A and tool slide above turret.

◀ Heavy lines indicate surfaces machined on workpiece.

With workpieces weighing approximately 50 pounds, this method of loading and unloading has not only increased production by cutting unproductive time but has also reduced operator fatigue.

GISHOLT

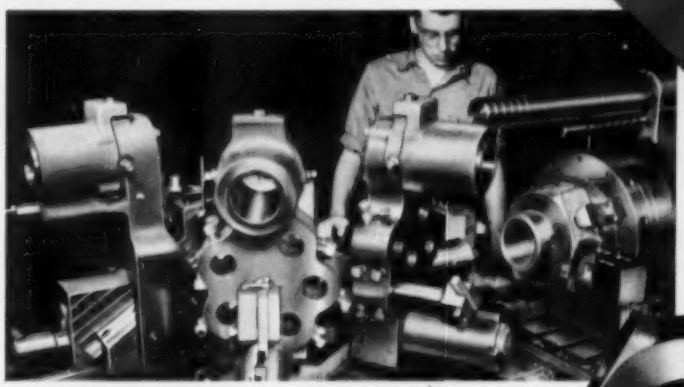
TIME-SAVING IDEAS

AUTOMATIC TURRET LATHE CUTS COSTS ON SMALL LOT OPERATIONS

Versatile 2F Fastermatic Minimizes Effort, Shortens Change-over

This manufacturer, with minimum investment, has improved medium-run machining operations on eight different types of pump bodies and housings. The workpiece shown is typical. A pot-type fixture is used, with the part locating against a previously machined face on a locating ring mating with a pilot diameter on the back of the part. Draw-back fingers hold in opposed port openings. The machining sequence is shown by the line drawings. Floor-to-floor time is only 9.40 minutes.

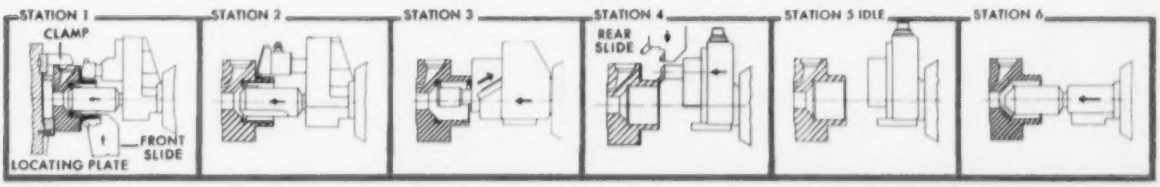
Piloted multiple turning heads provide maximum support and flexibility. Massive tool holders reduce overhang for accuracy and rigidity during heavy cuts. Adjustable block-type cutters speed boring operations and are interchangeable for different bore sizes. Special cross slide cams provide extra travel for facing the larger parts. Adjustable, tee-slotted tops further speed change-over.



Recess at base of bore is formed by internal facing tool at left, actuated by adjustable stop bar under overhead pilot on headstock.

Pump housing, showing surfaces machined. Large face is 9¾" in diameter; hub diameter is 6½".

Heavy cuts are taken at maximum feeds and speeds with the ease and efficiency offered by automatic operation. Production is fast and quality consistent. During machining, the operator is free to inspect parts or perform other work.



STEPS UP PROFITS ON STEEL END MILL ARBORS

JETracer on Rear of Cross Slide Cuts Costs, Speeds Production

You may get ideas here on cost-cutting with this combination—the new Gisholt MASTERLINE No. 5 Ram Type Turret Lathe with JETracer. Here's how they team up to machine the shank end of tough steel end mill arbor forgings, in only 9.73 minutes floor-to-floor time:

A hydraulically operated collet chuck holds the work. A-B-E-G are rough-machined by square turret tools from the front of the cross slide. The tracer slide carries a quick-indexing type square turret with roughing and finishing tools. In two fast passes, the JETracer rough- and finish-machines G-F-E-D-C-B-A, completing the O.D. The JETracer then retracts out of the way while standard tools on the hexagon turret center drill, drill L, co-bore J, form H and tap K to finish the operation.

This combination provides all advantages of tracer operation, plus unrestricted use of hexagon turret for all additional operations on the I. D. of the piece.

An indexing square turret on the Gisholt JETracer slide permits heavy roughing cuts and a light finish cut with a fresh second tool for close tolerance machining operations.

GISHOLT

MASTERLINE GISHOLT SINCE 1887

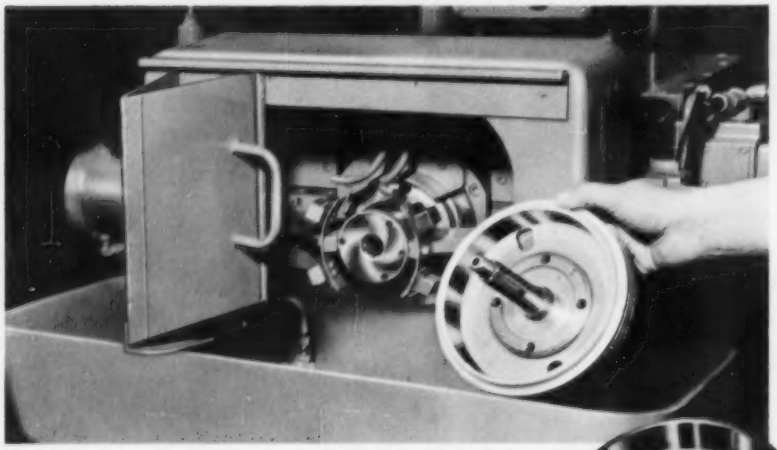
TIME-SAVING IDEAS

GRINDING OPERATION ELIMINATED BY BRAKE DRUM SUPERFINISHER

Brake Drums Superfinished for More Area Contact, Longer Life

By combining expert setup with an advanced process, a leading automotive manufacturer is improving quality, cutting costs and lengthening service life on rear brake drums. The process is Superfinishing—and the machine is a Gisholt Model 57 Brake Drum Superfinisher.

An air-operated collet chuck holds the work on the rear brake drum shaft. Depth stop is an internal plug, with drive against the splined shaft. After rough- and finish-boring, the braking surface is Superfinished down to ten micro inches R.M.S., or less. Floor-to-floor time per unit on this job is only 20 seconds—and savings are realized through elimination of the usual grinding operation.



Gisholt Model 57 Brake Drum Superfinisher, showing workpiece, collet chuck and Superfinishing stones which move out to engage the brake drum I. D.

Time is saved and unit cost is lowered with this setup—and the Superfinishing provides a better braking surface for faster, safer stopping action.

Front brake drum is also Superfinished on second machine.

ADHESIVE LEAD FOIL CORRECTS ROTOR UNBALANCE

Note size of workpiece compared to operator's hand. Sections of adhesive lead foil are cut to size and positioned for ready use.

Unique Method with DYNETRIC Balancer Corrects Lightweight Parts

Here is a dramatic application which demonstrates the extreme accuracy of all standard Gisholt Balancing Machines. This job—handled by a 1S DYNETRIC Balancer with lightweight work supports—is a miniature D.C. motor rotor. The rotating section, a hollow wire winding weighing only 0.637 ounce, rotates about a central heavy core and shaft and requires a two-plane balancing operation.

Loading and unloading are simplified by balancing in an over-hanging position. Belt drive is used to rotate the workpiece at approximately 3000 r.p.m. Correction planes are located on each side of the winding, at a 0.625" radius from center. The problem of the large parasitic mass of the central core, shaft and arbor is overcome—because Gisholt Balancers amplify unbalance effects electrically. By calibrating the Direct Reading Amount Meter, one unit on the meter is made to represent a ⅛" x ¼" piece of adhesive lead foil weighing only .001 ounce. The meter tells the exact amount of correction needed, and the strobe lamp tells the operator precisely where to apply the foil on each side of the winding. While still on the supporting arbor, the part is then corrected and inspected to make sure residual unbalance is less than ½ a meter unit—and the job is completed, in less than one minute f.t.f.!

From the smallest to the largest rotating parts, you'll find a standard Gisholt Balancer available to meet your needs. Write for new general Catalog 1109-B.

DYNETRIC BALANCERS GISHOLT

No. 3-456

654

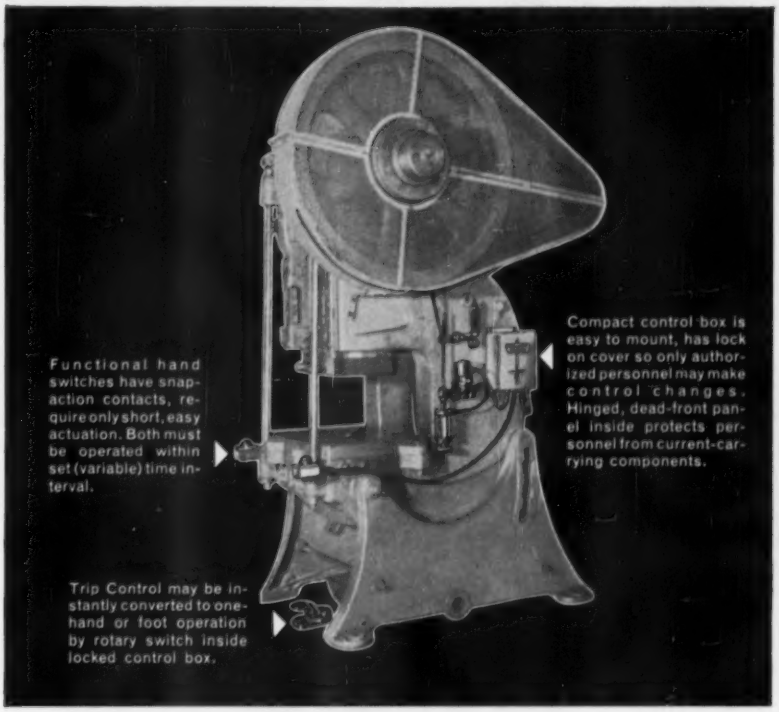
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN


Functional hand switches have snap-action contacts, require only short, easy actuation. Both must be operated within set (variable) time interval.
Compact control box is easy to mount, has lock on cover so only authorized personnel may make control changes. Hinged, dead-front panel inside protects personnel from current-carrying components.
Trip Control may be instantly converted to one-hand or foot operation by rotary switch inside locked control box.

Increase production...3 ways... with MICRO SWITCH Trip Controls

MICRO SWITCH Trip Control will speed production and provide safety to the operator and equipment on any power machine that will lend itself to two-hand control.

1 Less operator fatigue: Simple direct operating motions, feather-touch finger-tip operation of the control switches, and the absence of gates, harnesses or sweeps keep the operator fresh and alert.

2 Increased operator confidence: Without worry over personal safety, operators soon develop a smooth, time-saving "load," "trip," and "unload" sequence.

3 Instantaneous electrical actuation of the clutch: Saves time on every operation.

Outstanding safety features

Reduces chance of accidental operation. Operation can result only when control system is functioning properly. The control becomes inoperable if a component fails.

Control cannot be "cheated" for even one stroke: If one switch is tied down or broken, the control will automatically kick out.

Interlock prevents accidental power stroke during set-up. Operators, set-up men, and expensive dies are protected during set-up. The interlock prevents an unexpected stroke when the motor is started up again.

MICRO SWITCH Trip Controls have wide range of uses

These controls offer a choice of desirable single-stroke control for positive mechanical clutch machines and automatic cycling control for friction clutches and hydraulic and pneumatic equipment.

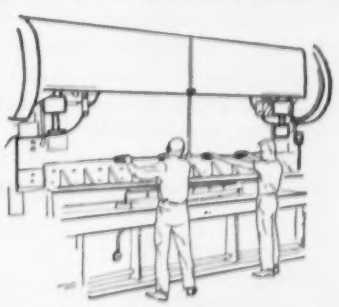
FOR SMALL PRESSES

Provides fast, safe, effortless operation of small two-hand presses, riveting machines, etc.

ONE HAND—IF NECESSARY

Where one hand is required to hold stock in a protected or enclosed die, control is quickly converted to one-hand operation.

FOR USE ON LARGE PRESSES



Makes operation of large presses safe and less tiring. Any number of operator stations may be "wired into" the control circuit.

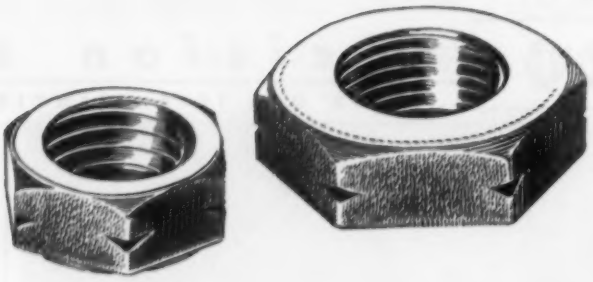
SEND FOR CATALOG 65 TODAY
Gives complete description of all controls and clutch actuating equipment.

There is a MICRO SWITCH Trip Control distributor near you. Write us for his name and address.

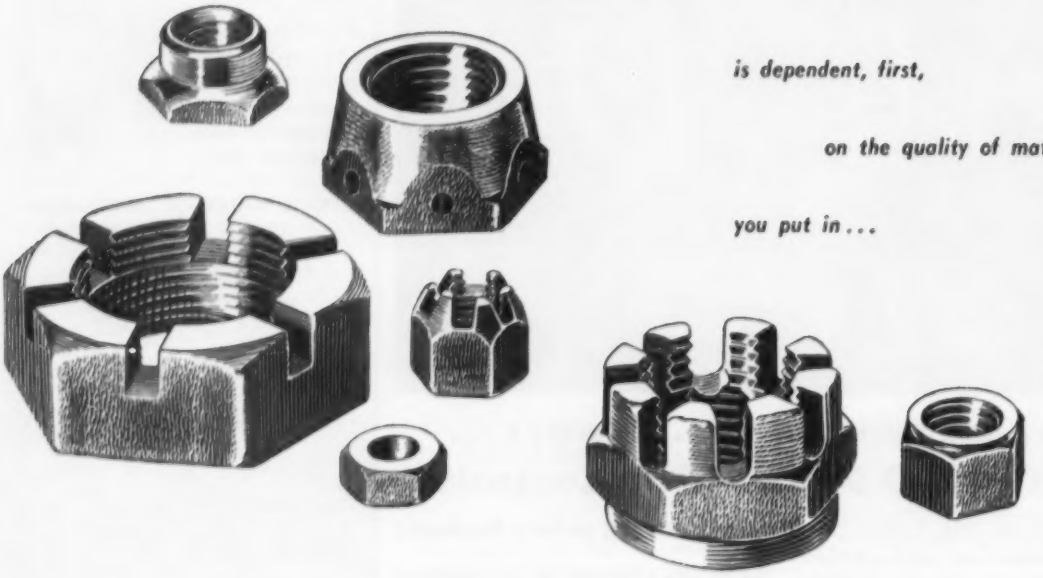
MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS



the quality of product you get out of a machine –



is dependent, first,

on the quality of material

you put in . . .

The expression, "mass perfection", might well be applied to nuts of the quality illustrated above. Some are simple, others complicated. But, all bear the unmistakable mark of quality—a mark inherent in the products produced from Youngstown Cold Finished Bars.

There are no stringy chips to get caught in the cut-off blade on an automatic; they're small and break off easily. In fact, you can eliminate most grinding operations.

Youngstown Cold Finished Bars have that desirable uniformity and machineability. They are free of injurious seams. Cracked steel rarely turns up. If you use automatics, it will pay you to get in touch with your nearest Youngstown District Sales Office.

QUALITY YOUNGSTOWN SERVICE

Youngstown Cold Finished Bars

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

THEY WOULDN'T BELIEVE IT

—until they SAW it!

Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough alloy steel forgings. So they came to see for themselves and they saw:

1. Cuts 1⅛" deep.
2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

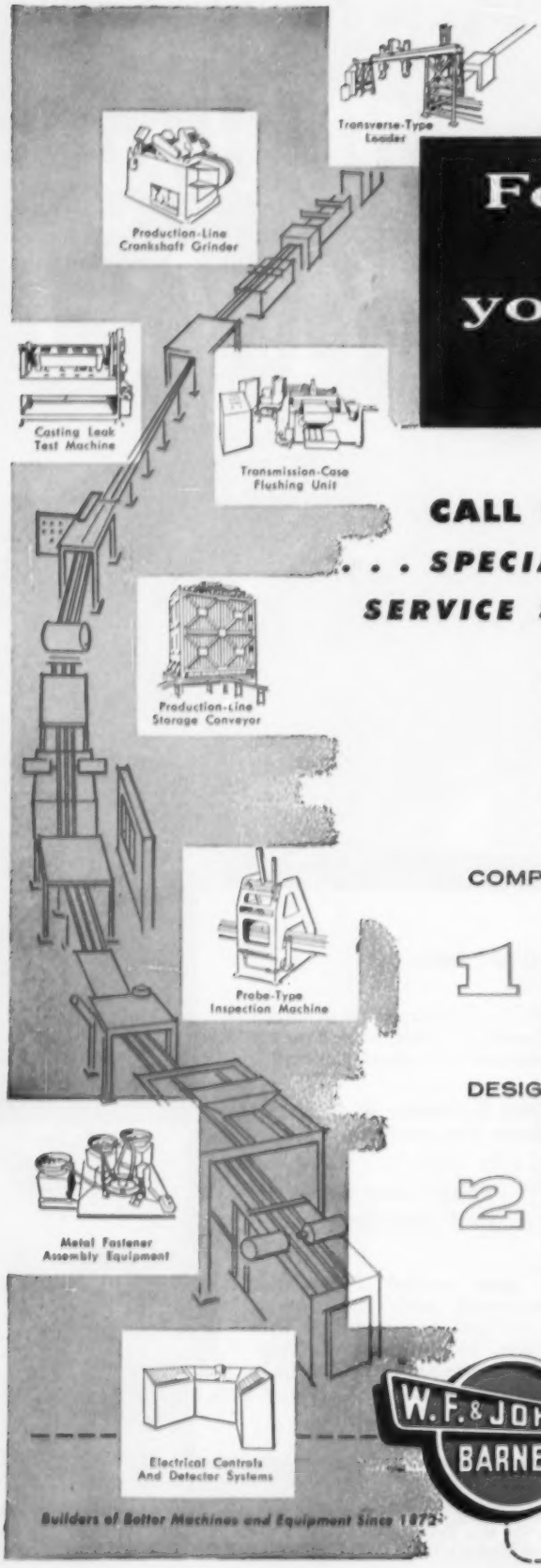
They were amazed and convinced.

This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



For a practical solution to your automation problems . . . .

CALL ON W. F. & JOHN BARNES

. . . SPECIAL TWO-FOLD COORDINATED SERVICE SOLVES PROBLEMS QUICKLY

More and more production executives than ever before are today turning to Barnes for help in designing and building specialized automation equipment. With 80 years of practical machine building experience, Barnes have been called upon to design and build hundreds of different types of automatic handling and special processing equipment as well as special high production machine tools. Now, to better serve demands and help you solve automation problems quickly, Barnes offers a two-fold coordinated service:

COMPLETE PRODUCTION-LINE ENGINEERING

1

If you are planning new production-line methods for either automatic or semi-automatic operations, an experienced engineering staff is available to work with you. The detailed plans and proposals submitted for your consideration can be depended upon to provide you with the latest in automation engineering and the very best of proven mechanical, hydraulic, and electrical actuation. Ask for a free survey of your problems early in your planning program.

DESIGNING & BUILDING SPECIALIZED UNITS

2

Designing and building specialized, individual units to suit your specific needs is a separate, additional service. Where required, electrical, mechanical, hydraulic, fixture, and tool engineers work together as a team. All efforts are closely coordinated with complete manufacturing facilities to save you time and eliminate divided responsibility. As illustrated, this service covers hundreds of different types of automatic processing and work-handling units that are today profitably serving a wide range of industrial needs.

ANALYSIS OF METHODS — Call on Barnes engineers today for a practical solution to your automation problems. Or, ask for an analysis without obligation.

W. F. & JOHN BARNES

AUTOMATION SECTION

413 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

Pick Your Special Electrodes

From Hundreds of Existing MALLORY Designs

Need odd-shaped electrodes for resistance welding around corners, inside channels, or other out-of-the-ordinary places?

Before you go to the time and expense of ordering custom-made special electrodes, see what Mallory existing designs can do for your job. We have flexible tooling available for hundreds of different odd-shaped electrodes. What you consider a "special" may well be an existing Mallory type that you can get on prompt delivery . . . and at economical cost.

Included in the Mallory line are cold formed single bend and double bend types. Also, cast and forged offset designs. You have a wide choice of nose shapes, tapers and lengths. Bent electrodes are made by an exclusive Mallory cold-forming technique which develops maximum strength and hardness, to assure long life. Both single and double bend types can be supplied with fluted cooling holes and water tubes bent in place*, to assure highly efficient cooling right up to the welding face. All types use specialized alloys and manufacturing methods which Mallory has developed during thirty years of pioneering and leadership in the resistance welding field.

Stock Mallory straight electrodes, holders, seam welding wheels, dies, forgings and castings are listed in the latest edition of our Resistance Welding Catalog. Write today for this valuable reference book . . . and see your local Mallory welding distributor for prompt delivery of high quality welding supplies.

*Patent No. 2,489,993.

30 Years of Resistance Welding Leadership

Expect more . . . Get more from

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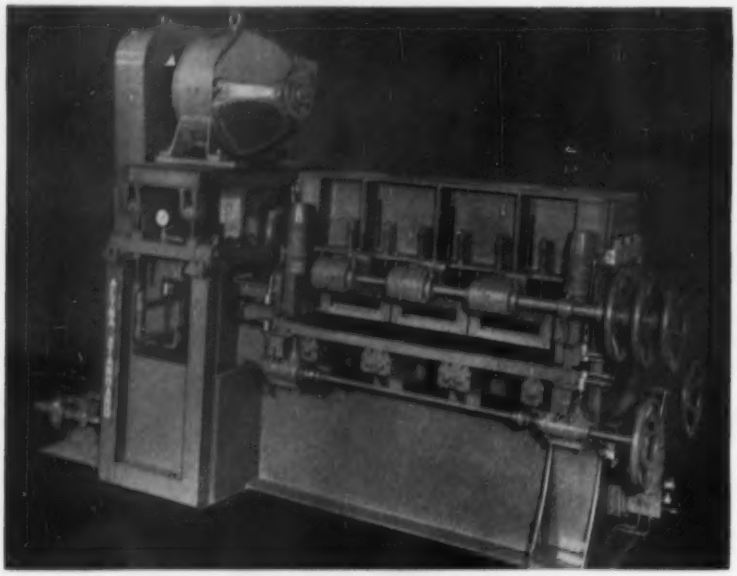
BEARING TIPS by McGill



138 GUIDEROL® BEARINGS BACK UP WORK ROLLS IN AETNA STANDARD LEVELER

High load capacity vital to back-up roll support

For processing 16 to 30 gauge steel sheets and coils, this Roller Leveler built by Aetna Standard Engineering Company requires dependable components to deliver a consistent maximum output at speeds up to 400 feet a minute.

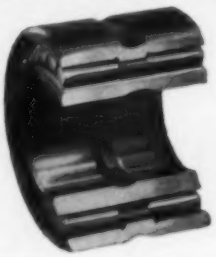
McGill GUIDEROL GR-16 bearings were selected for this machine and several larger versions use GR-24 and GR-36 bearings. They can carry the heavy irregular loads associated with flattening and leveling steel sheets and strips. Requiring less radial space, Guiderol bearings provide maximum roll neck diameters and offer greater strength at the necks of larger back-up rollers.

On the machine shown above, there is a total of 36 back-up rollers in 3 upper banks and 33 in 3 lower banks to resist the heavy pressure of the 48 inch working rolls. With a GUIDEROL bearing at each end of the 1¾" back-up rolls, a total of 138 bearings is required for the Leveler. These bearings have proved especially suited to supporting heavy loads longer in small radial space with reduced maintenance and production down time — important in steel mill operations.

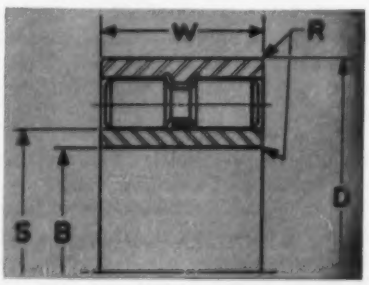
American Hoist Uses CT Series In Crane Blocks

Crane Blocks built by American Hoist and Derrick to withstand the greater strains and rough usage of lifts up to 500 tons rely on the greater capacity of GUIDEROL CT Series bearings in the sheaves. Interchangeable with retainer type cylindrical roller bearings, the CT Series full type roller construction has added capacity of over 38%. In sheaves these bearings offer greater angular stability with full race width rollers. Center guiding without retainer keeps these rollers aligned and prevents binding under eccentric loads.

Center-Guided Rollers Eliminate Load Wasting Cages



Guiderol Bearings inherently possess exceptionally high radial load capacity due to their full complement of small diameter rollers. Grooved rollers and a center guide rail keep rollers aligned as insurance against skewing and binding that is possible with ordinary needle bearings. Sizes interchange with needle and cylindrical roller bearings.



CT Series Adds Guided Roller Advantages to Cylindrical Roller and Ball Bearing Sizes

CT Series Guiderol Bearings provide the load carrying advantages of center guided rollers in cylindrical roller and ball bearing sizes. They are interchangeable in both single and double row dimensions. Inner rings are separable and may be eliminated to reduce radial space.

140 Pages of Bearing Facts

Write for your copy of Catalog No. 52, a revised 140-page Bearing Selection Guide. It contains vital product information and 30 pages of engineering data.

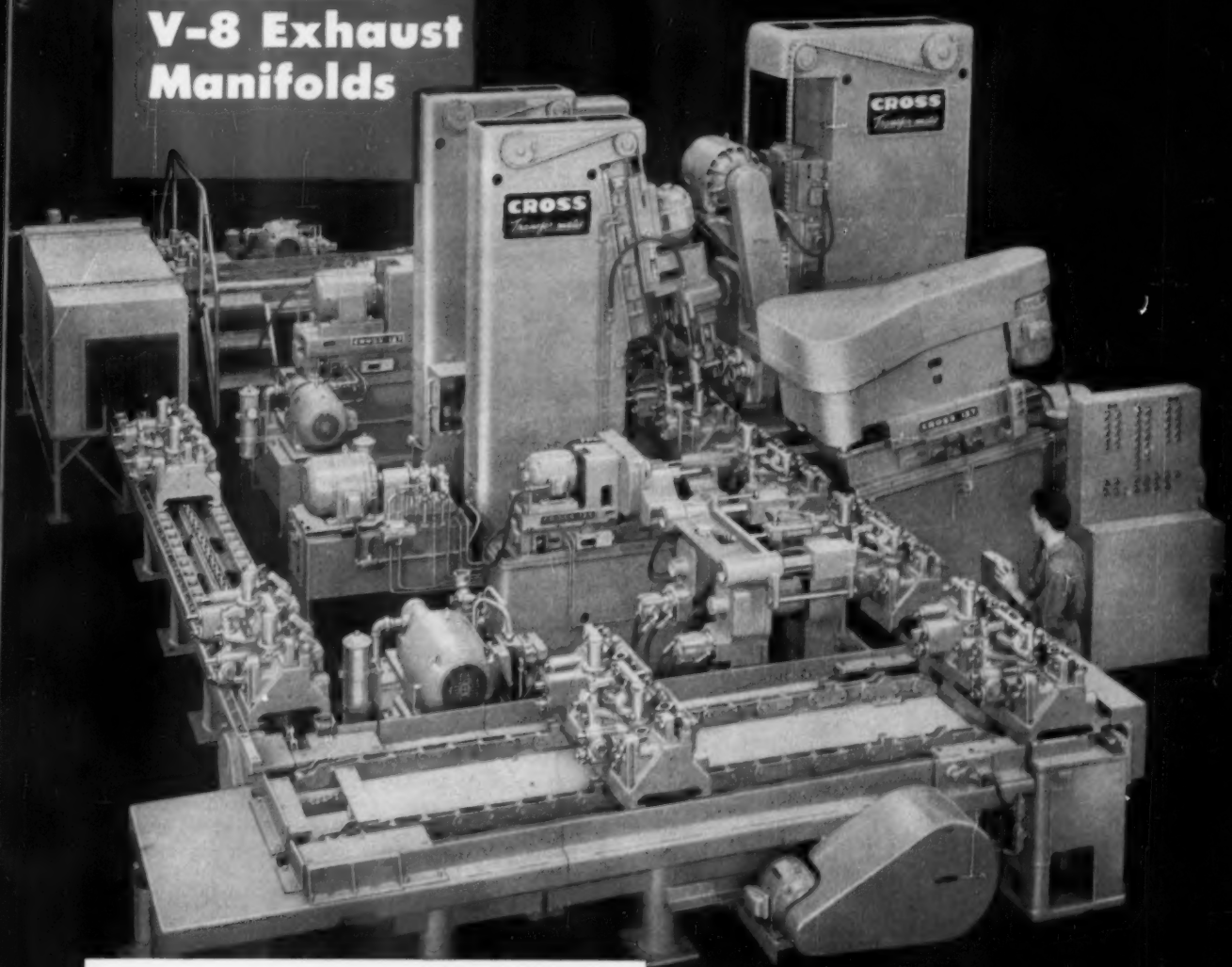
Insure performance with McGILL

MULTIROL® GUIDEROL® CAMROL
Full Type Roller Bearings

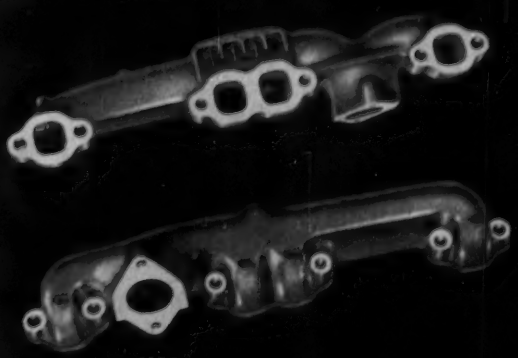
McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA

Completely Machines V-8 Exhaust Manifolds

Another Transfer-matic by Cross



- ★ 51 operations: 8 milling; 37 drilling, chamfering and spotfacing; and 6 tapping.
- ★ Palletized work holding fixtures for holding one right hand and one left hand part.
- ★ Automatic power wrench for operating work holding fixtures.
- ★ Automatic transfer mechanism.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping.



Established 1898

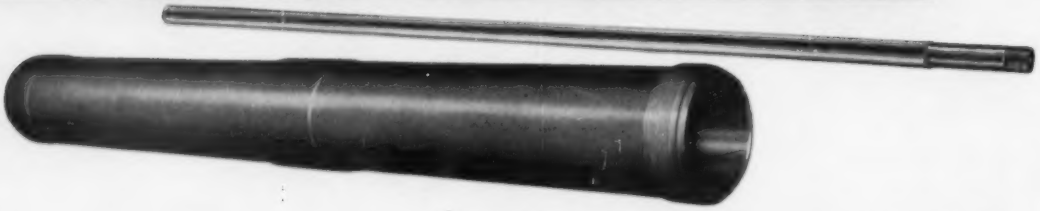
THE CROSS CO.

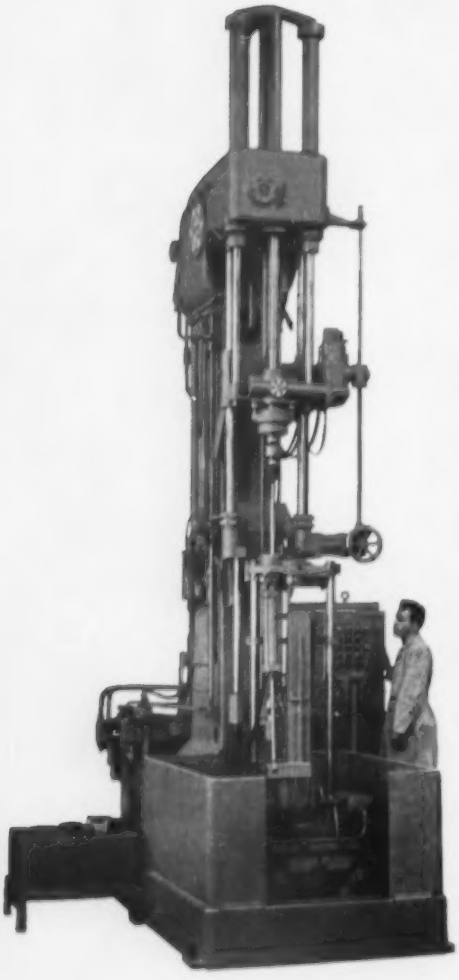
First in Automation

DETROIT 7, MICHIGAN

MICROHONING*...

Efficient Stock Removal
with
LOW-VELOCITY ABRADING





INCREASINGLY, process engineers are recognizing Microhoning's low-velocity abrading technique as a means of combining efficient stock removal with precision.

The Brooklyn Works of American Machine & Foundry Company, in the precision-manufacture of recoil mechanisms for artillery weapons, required a process that would most efficiently remove substantial amounts of stock and generate functional surface characteristics on the I.D. of recoil cylinders and O.D. of piston rods. After extensive study of available methods, AMF selected Microhoning as the most productive and economical process for obtaining desired results.

The floating piston in the recoil cylinder has nitrogen gas on one side and hydraulic oil on the other. Because silver ring seals are used, any error in geometry or roughness of cylinder or rod surfaces will induce deformation or scoring of silver rings and break these important seals.

The largest cylinder processed by AMF to date is for a 75 mm gun and has a bore diameter of 4.750 inches and a length of 46 inches. Piston rods for this gun are 1.375 inches in diameter and 56 inches long. Both I.D. and O.D. operations are on the same Microhoning machine—Model 450 Hydrohoner.

The Microhoning process efficiently removes up to .026 inch of stock from cylinders and .006 inch from rods to correct waviness, taper and out-of-roundness. A geometric tolerance of .0001 inch is held while obtaining a 1.5 microinch finish.

Working closely with AMF manufacturing personnel, Micromatic developed fixtures and tooling that minimize changeover time. The fixture for the cylinder is mounted on an indexing table so it is simply indexed away from the spindle while the rod is being Microhoned. You, too, can solve your precision stock-removal problems through application of Microhoning—the low-velocity abrading process.

For further information write for CROSS-HATCH, Vol. 7 No. 5

*MICROHONING=
Stock Removal + Geometry + Size Control + Surface Finish

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

No other automatic on the market provides as high a degree of accuracy for work up to 2" diam. as the Brown & Sharpe No. 4 Automatic Screw Machine! And its advanced design permits top productivity on every job. For example: Super-precise spindle construction allows limits as close as 0.0003" — even at top speeds! Engineered production rates for each job *assure* maximum precision and efficiency under all conditions — hold repetitive production to close tolerances. A large, extra-convenient turret speeds set-ups and adjustments. In addition, electric control allows tools to be "jogged" easily into position; or a complete cycle to be run through by hand. And the No. 4's exclusive spider-wheel stock loader enables even a 100-lb. girl operator to easily engage a 2" bar! The unique capabilities of the No. 4 Automatic are making possible new profits in precision production — even on critical jobs like the one illustrated. It's the most *practical* automatic for all larger precision work. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

THE MOST ACCURATE AUTOMATIC for larger work!

. . . the Brown & Sharpe No. 4 Automatic Screw Machine

MACHINE SPECIFICATIONS

Stock diameter	to 2"
Stock diameter (with outside feed)	to 2⅝"
Speed range	1965 to 17 R.P.M.
2-speed combinations	168
Speed ratios (12)	2.2:1 to 13:1

Even this Job is Easy on the No. 4!

Tolerances:
Bore I.D. 0.0003" to 0.0004"
Concentricity of bore 0.0005"
Large O.D. 0.0005"
(Overall diameter of work approx. 2")

Brown & Sharpe

HARDINGE
ELMIRA, N.Y.

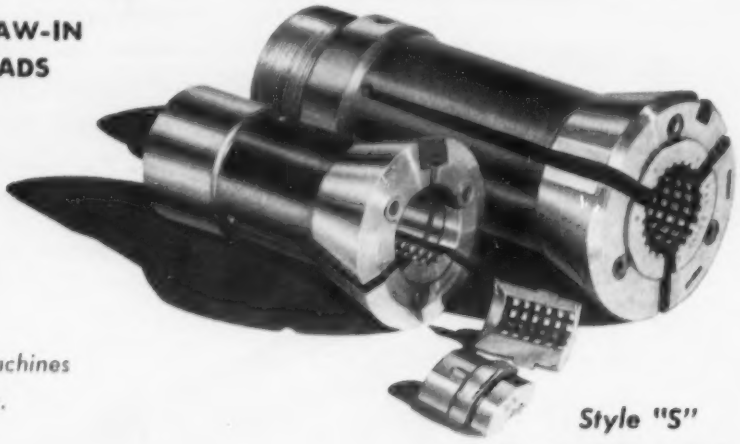
MASTERS and PADS

for **BETTER PERFORMANCE** *and* **BETTER PRODUCTION**

STYLE "S" SURE-GRIP DRAW-IN MASTER COLLETS and PADS

Cleveland
Cone
Greenlee
Gridley and Acme-Gridley
National Acme
New Britain
Warner & Swasey

Available for all sizes of above machines up to and including 3½" capacity.



Style "S"

The Only Master Collet With No Work Pressure On The Screw

STYLE "B" MASTER FEED FINGERS and PADS

Brown & Sharpe
Cleveland
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National Acme
New Britain
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Available for all sizes of above machines up to and including 3½" capacity.

Style "B"

Pads Cannot Work Loose
No Screws — No Pins

Ask for Style "S" and Style "B" Bulletins which give all performance features, price savings, and ordering information

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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Immediate stock delivery from Minneapolis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, New York.

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in cold finished carbon steel bars
"J&L 1200"
"J & L 1200" Steel provides the qualities that help machine operators do top-flight work at lower overall costs. With "J&L 1200," the operator obtains: better machine finishes . . . longer tool life . . . higher rates of speed. This fact has been proven time and again—in shop after shop.
"J&L 1200" grades meet the compositions published by the A.I.S.I. . . . S.A.E. . . . and Federal Specifications QQS-633. Try this steel in your own shop. Results will convince you "J&L 1200" deserves to be a regular specification for your production runs.
Use "J&L 1200" steel on your tough jobs for . . .
tops in quality
tops in machinability
tops in uniformity
tops in finish
available in all standard shapes and sizes
J&L STEEL
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STEEL CORPORATION — Pittsburgh

For effective, efficient lubrication of machine tools, use—

GULF HARMONY OIL

To insure fewer machine tool maintenance problems and lower maintenance costs, use the lubricant with all the properties that count:

- Exceptional oiliness characteristics
- Excellent resistance to oxidation
- High film strength
- Outstanding rust preventive and antifoam properties

Gulf Harmony Oil has all of these properties. It retards the formation of sludge deposits, maintains its original viscosity over a long period, protects against excessive wear and rust.

These same properties make Gulf Harmony the ideal hydraulic fluid. It protects hydraulic equipment under severe conditions of pressure and temperature.

Have a Gulf Sales Engineer recommend the right grade of trouble-preventing Gulf Harmony Oil for your machine tools and hydraulic equipment. You'll find the number of your local Gulf office in the telephone directory.

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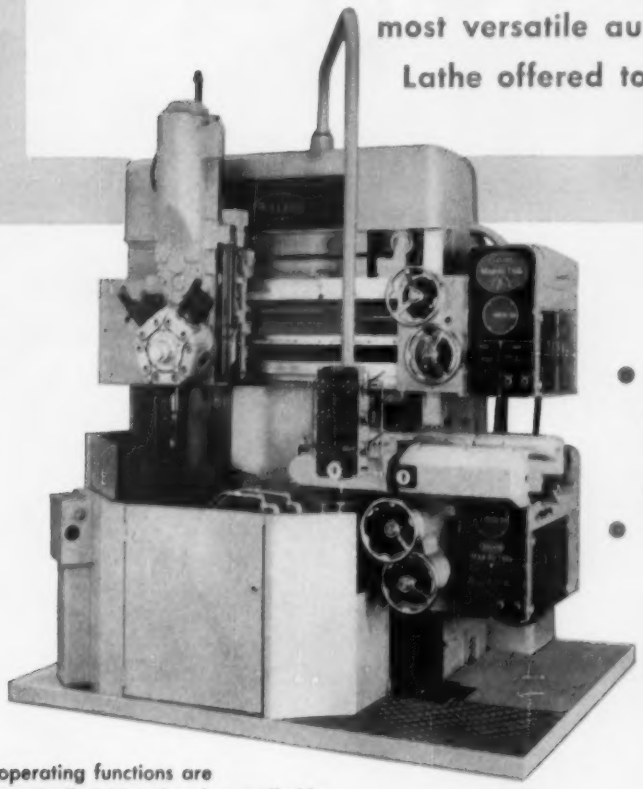
GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

don't BUY BULLARD *unless* YOU WANT THE BEST!

Yes, Bullard Cut Master, Model 75 with Man-Au-Trol Conversion Unit is the best . . . most versatile automatic Vertical Turret Lathe offered to industry today . . . . .



BULLARD

All operating functions are automatically initiated and controlled by one function control drum and two detector drums in Man-Au-Trol: Table Speeds (20 Available), Feeds (16 Available), Head Travel in feed or traverse, right or left, up or down or 45° in any quadrant and Turret Indexing.

Since the function control drum can be pre-set for a given job in advance, the machine down time for job change-over is reduced to a minimum.

The Man-Au-Trol Conversion Unit can be applied to any or all heads of Cut Master, Model 75 right in your plant.

Your Bullard Sales Engineer will be glad to explain the many other advantages offered by Man-Au-Trol — your best buy in an automatic vertical turret lathe — call him or write for our new catalog.

THE BULLARD COMPANY

286 Canfield Avenue • Bridgeport 2, Connecticut

Please send me a copy of the
NEW MAN-AU-TROL, MODEL 75 CATALOG

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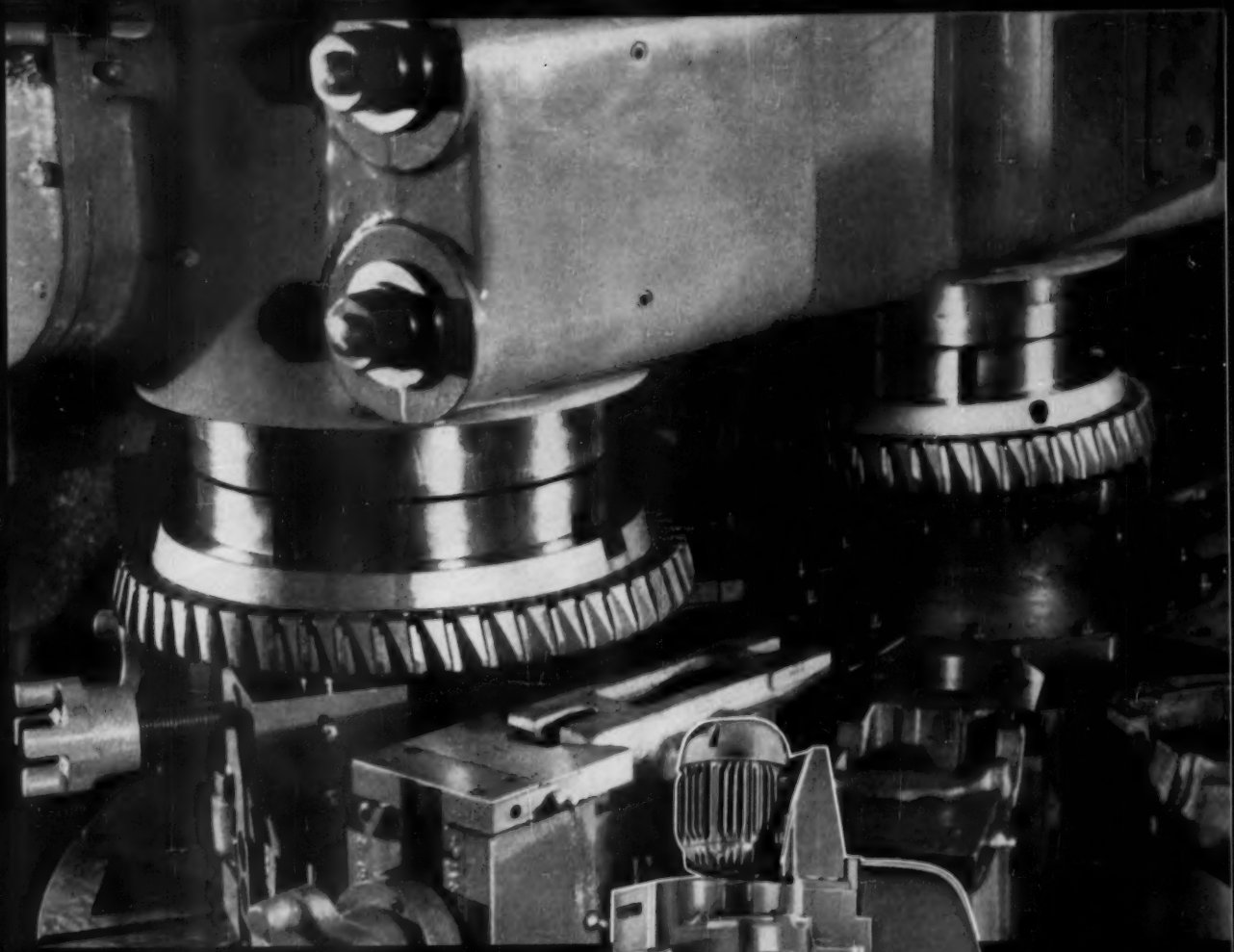
A Method . .

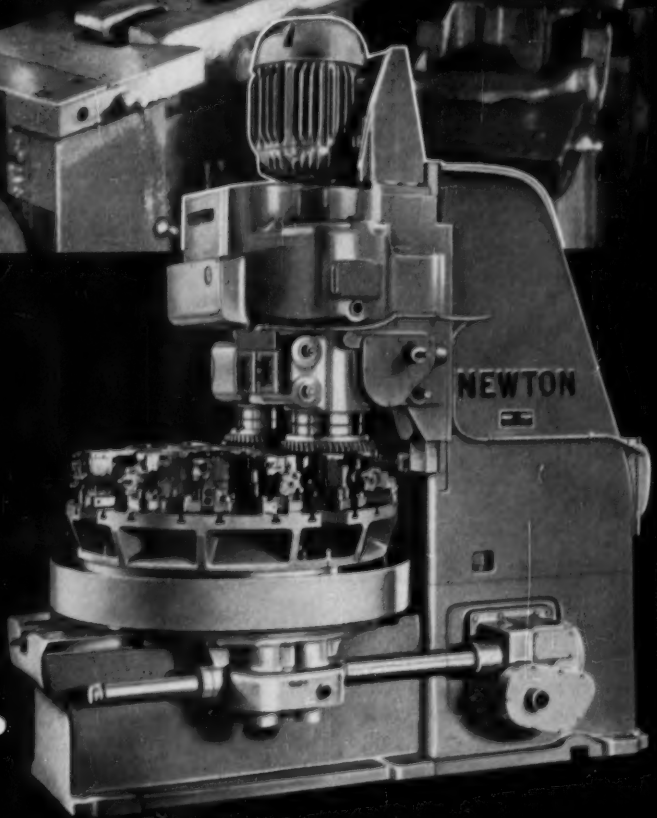
A Newton Vertical Rotary is more than a machine tool—it is a method—the *fastest known method* of milling the flat surfaces of repetitive pieces.

It is fastest because these machines mill continuously!

CONSOLIDATED MACHINE

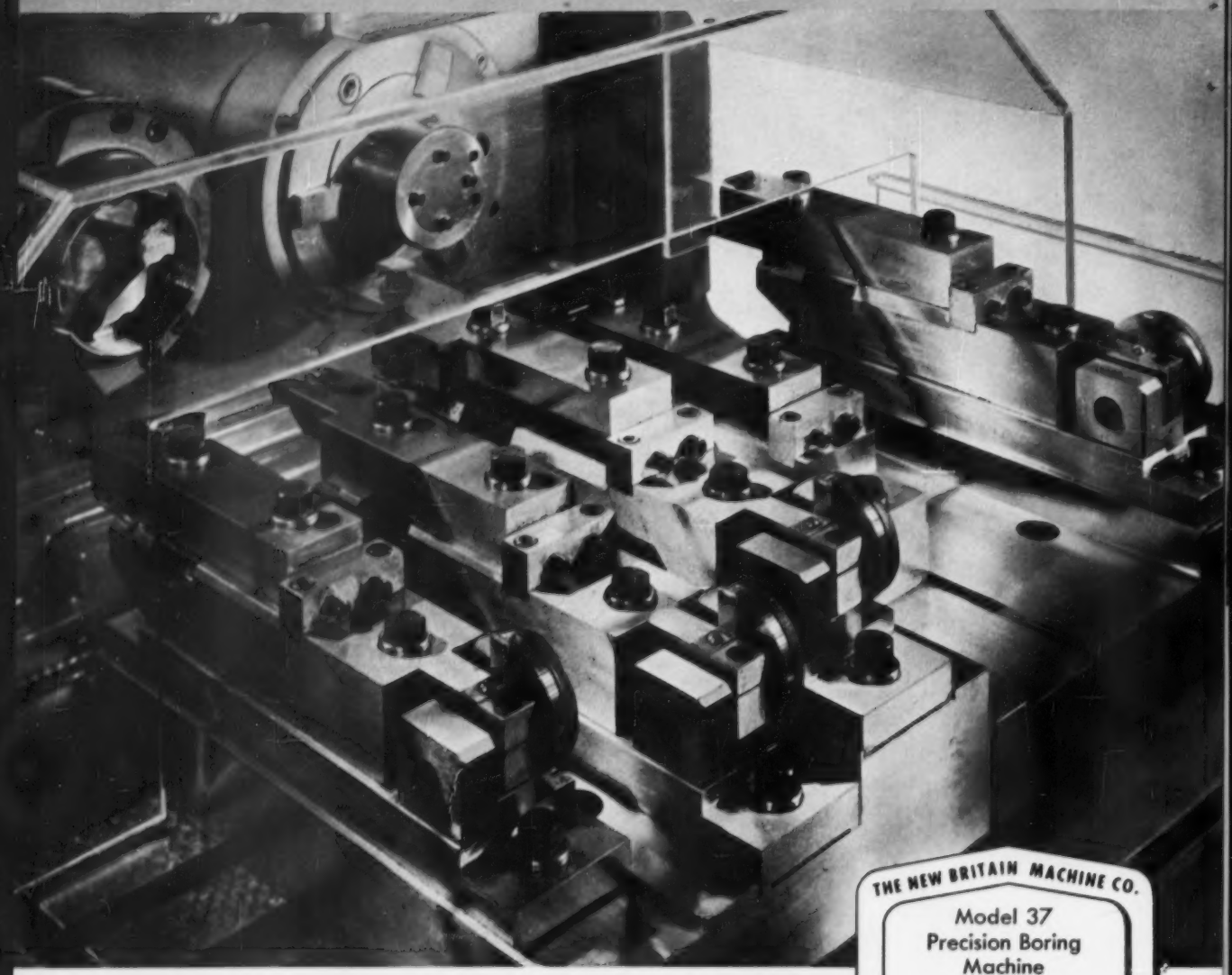
A DIVISION OF FARREL-





TOOL COMPANY ROCHESTER 10, NEW YORK

BIRMINGHAM CO., INC.



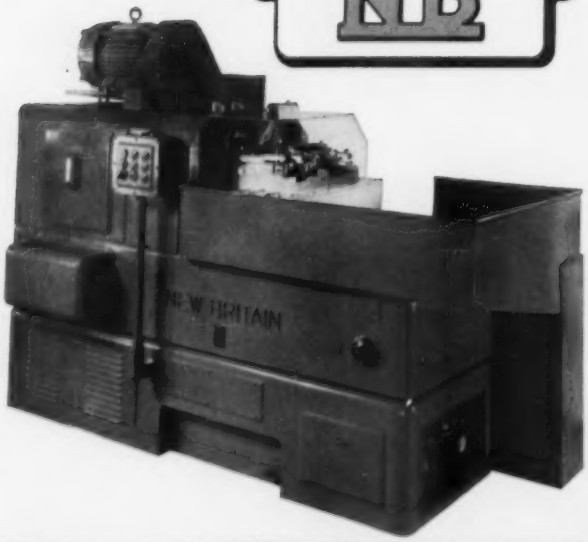
THE NEW BRITAIN MACHINE CO.

Model 37
Precision Boring
Machine

NB

need a fresh start?

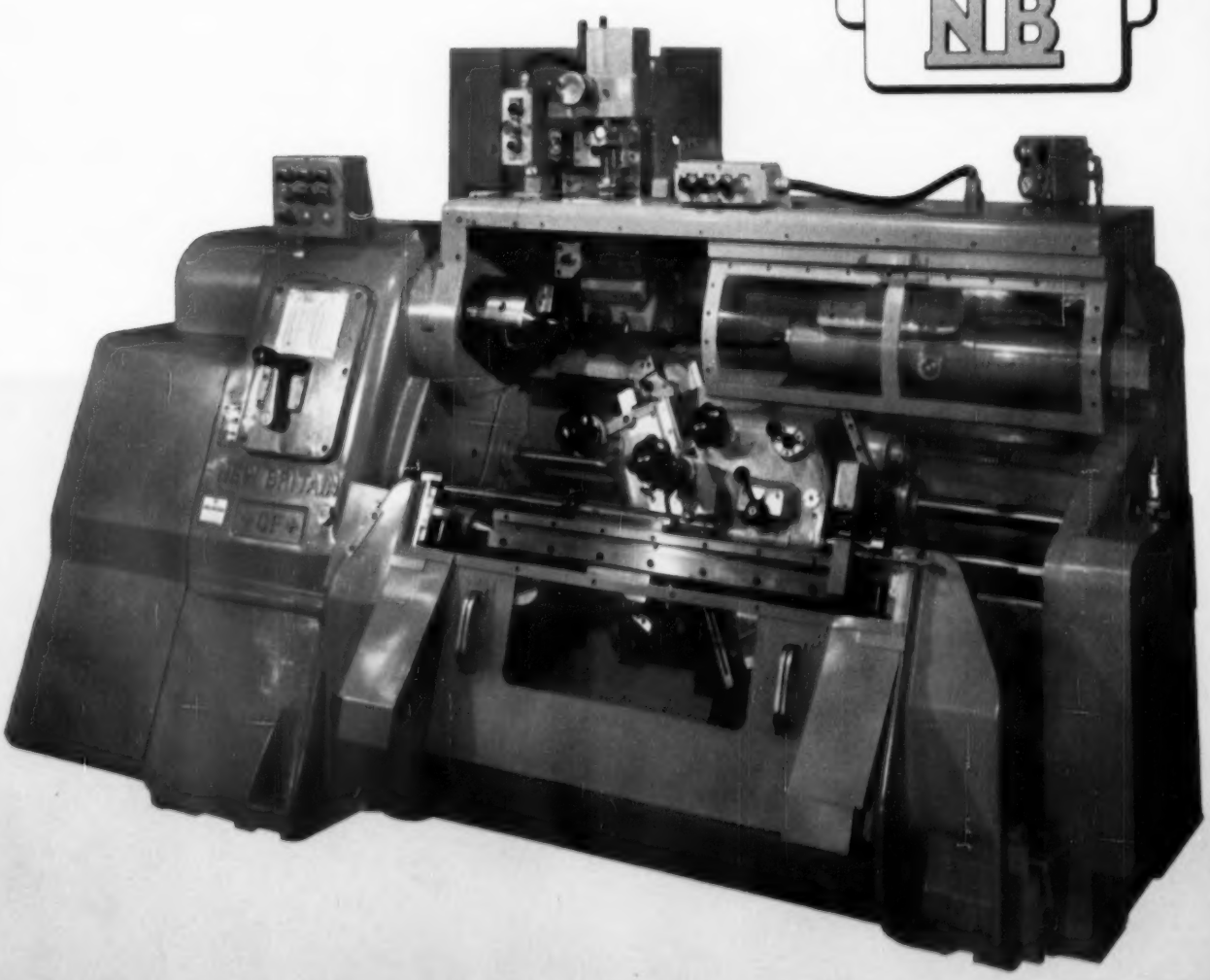
When you're stuck with "too much tooling" or costly second operations look into New Britain boring machines. New Britain's exclusive application of cam control may open up new methods, impossible on other types of machines. Low cost per piece is inherent in these New Britains, because of their versatility, high speed, high repetitive accuracy and inexpensive tooling.

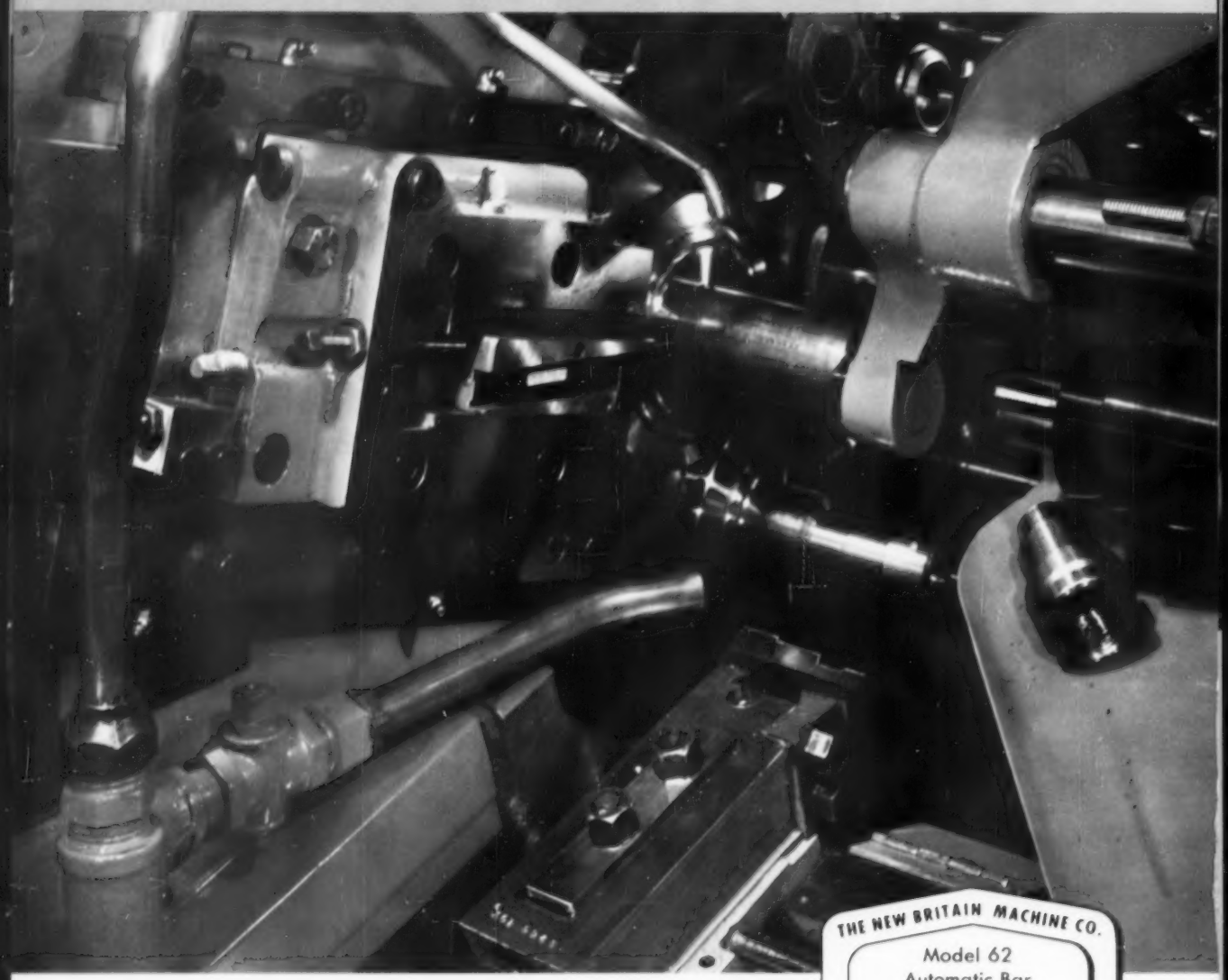


everywhere you turn...

You'll find New Britain +GF+ Copy Lathes are turning out pieces at profit. With a 15-minute setup on a standard model to make just a few pieces, or with an automatically loaded production model to run a million a year, the New Britain +GF+ approach can make money for you. For a complete color motion picture demonstration in your office, consult your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Model KDM 11/28
New Britain +GF+
Copying Lathe
NB





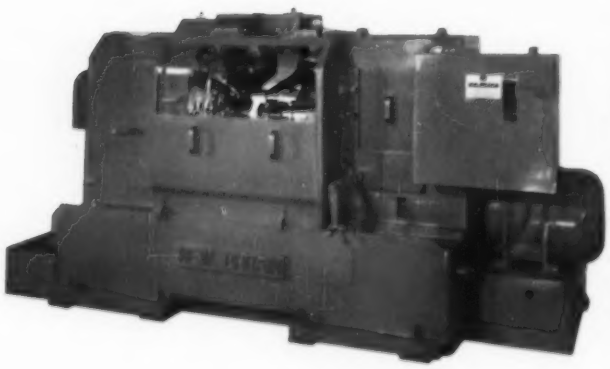
THE NEW BRITAIN MACHINE CO.

Model 62
Automatic Bar
Machine

NB

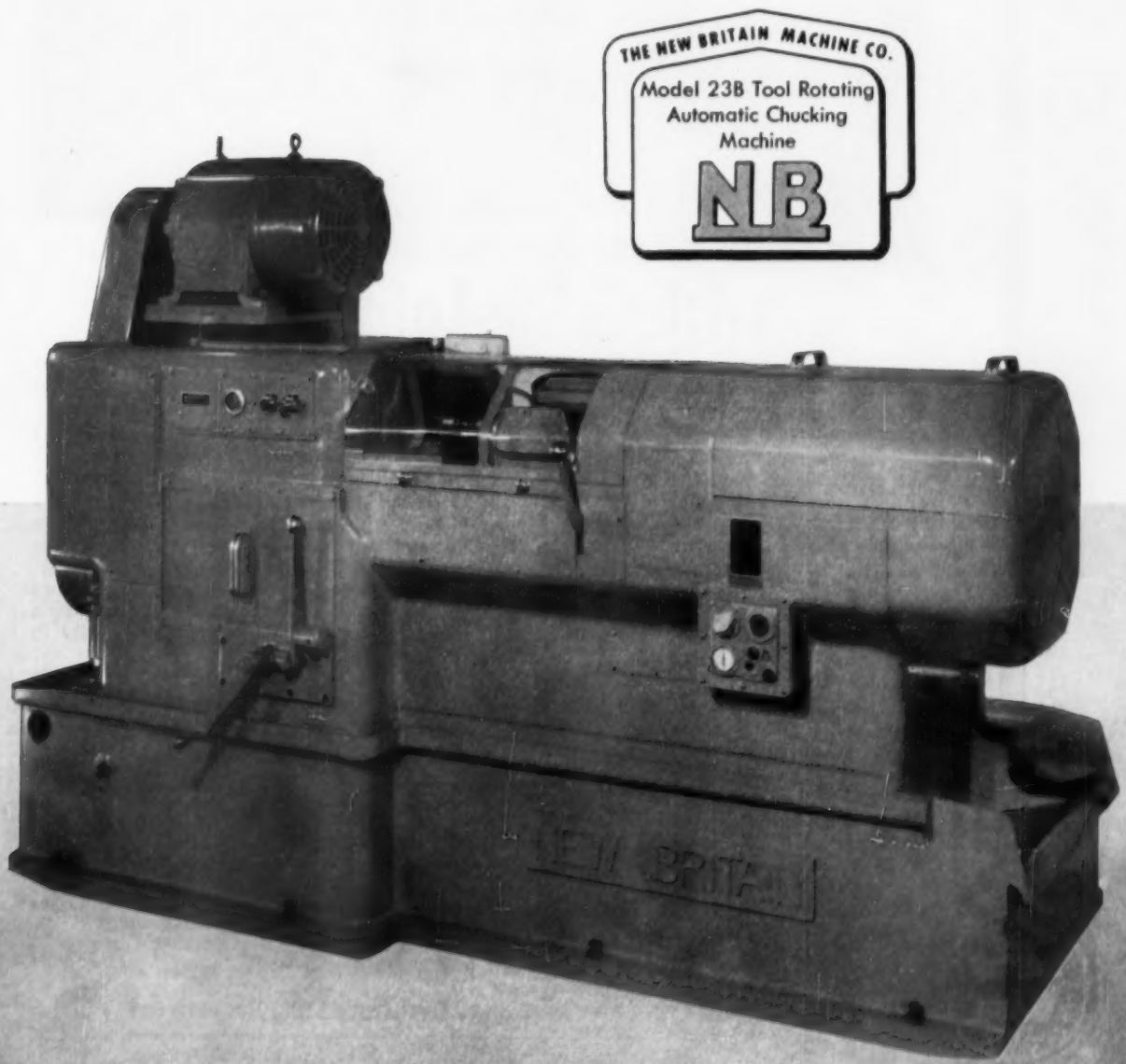
a rugged cross slide in every position

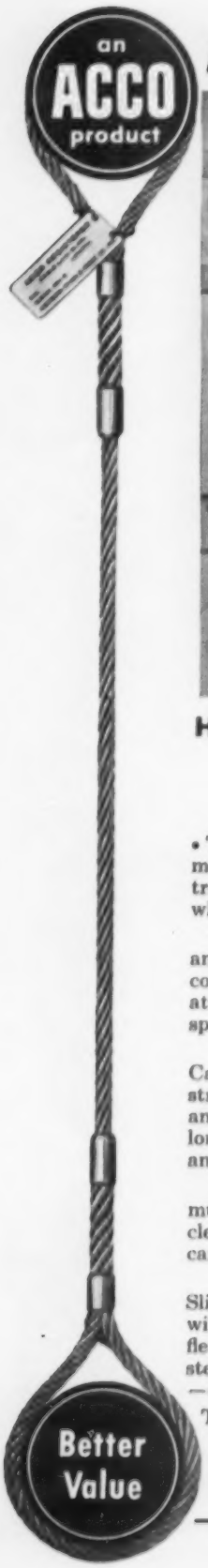
New Britain Models 60 and 61 Automatic Bar Machines are everywhere you turn. The new Model 62 represents new progress in rugged construction and versatility of setup. Your New Britain Representative can show you how to modernize at a profit. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



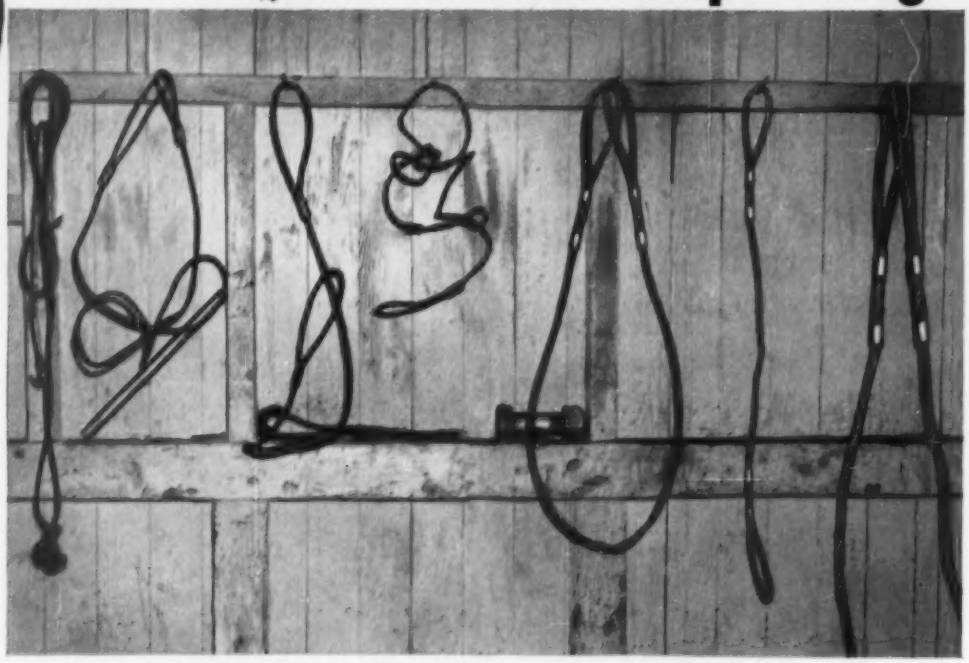
got a job you can't swing?

New Britain tool rotating chuckers are designed for high speed machining of irregularly shaped pieces which cannot be rotated on standard machines, and for second operation bar work. Model 23B has four spindles and five chucks, one position being reserved for loading. It indexes up to 1250 pieces per hour. For any problem involving automatic chuckers New Britain is headquarters. Consult your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.





ACCO Registered* Wire Rope Slings



HERE'S PROOF OF FREEDOM FROM KINKING . . .

with Cable-Laid Slings

• This sling board in an eastern plant may not make a pretty picture. But it beautifully illustrates savings in handling and production time which can mean big money.

At the far left are a length of hemp rope and metal barrel tongs. Next, three standard construction wire rope slings. The three slings at the right are ACCO *Registered* Slings in our special Cable-Laid construction.

Note the startling difference between the Cable-Laid Slings and those of standard construction. The standard slings are badly kinked and snarled. Hard to handle, they require much longer to rig up—add drastically to production and handling costs.

The Cable-Laid Slings have seen just as much service, possibly more. Yet, they're bright, clean and almost as straight as the day they came from the factory.

CUT RIGGING TIME • For ACCO Cable-Laid Slings combine extreme resistance to kinking with freedom from crankiness. They give the flexibility of manila rope with the strength of steel. As a result they handle easier—save time—cut operating costs.

These qualities are only possible through the combination of a special wire rope construction and the patented DUALOC ending. GALACCO coating keeps Cable-Laid Slings clean and bright and provides maximum corrosion-resistance.

SAFEST SLINGS MADE • ACCO Cable-Laid Slings are registered—incorporate extra safeguards which make them the safest slings made.

Each individual component, made from the highest quality material suited to its use, is tested before assembly—must prove to have strength equal to or greater than the sling body. These components are assembled into slings according to precisely-engineered designs which have proven their safety and reliability in extensive field tests.

Each completed sling is then proof-tested at twice the load-carrying capacity for which it is rated. Then, and only then, does it receive the coveted registration certificate and tag.

Get the details on Cable-Laid, or any other ACCO *Registered* Wire Rope Slings, from your distributor—or call the nearest ACCO district branch below. *Trade Mark Registered

FREE FOLDER • Write Wilkes-Barre office for your copy of new folder **DH-532**, which gives strengths and weights (for six different lifts) on a full size range of ACCO *Registered* Cable-Laid Slings.

ACCO

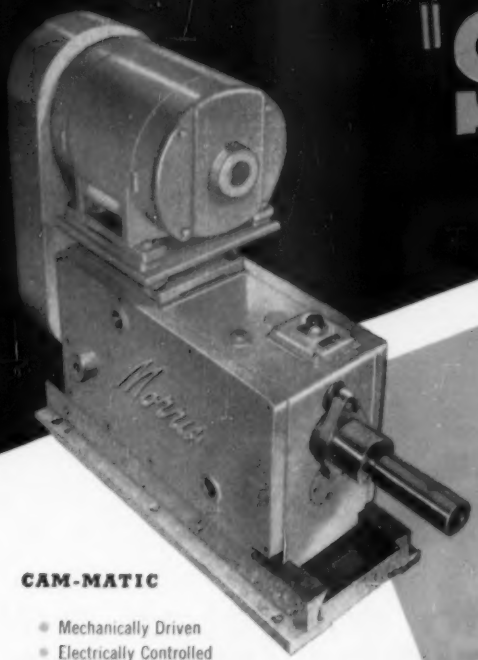
American Chain & Cable Company, Inc., Wire Rope Sling Department

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

BUILD YOUR OWN "Specials"

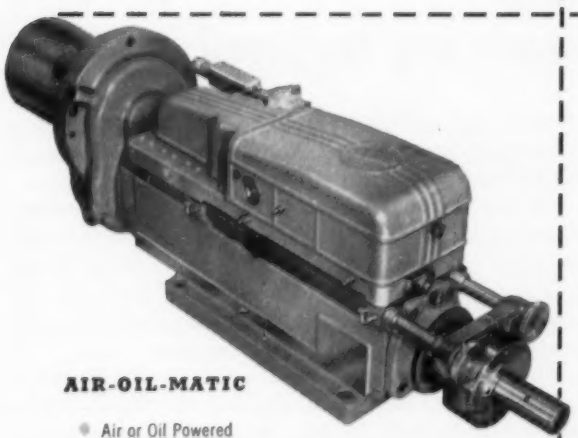
with

Morris AUTOMATIC DRILL UNITS



CAM-MATIC

- Mechanically Driven
- Electrically Controlled
- Rigid Quill Construction
- Exclusive Electric Clutch
- Adjustable Thrust Control
- Capacity to 1⅛", Stroke to 6"



AIR-OIL-MATIC

- Air or Oil Powered
- Oil Controlled
- Wide Range of Spindle Speeds
- Infinitely Variable Feed Stroke from 0" to 4½"
- 6" Maximum Stroke
- Convenient Feed and Stroke Adjustment

Whether you're building your own "special" production machine, organizing a completely automatic production line, or revamping drilling operations for more speed and higher efficiency . . . MORRIS Automatic Drill Units are flexible tools that assure improved drilling operation.

Choose from two basic types, in a variety of sizes and drives. Mount them in horizontal, vertical or angular positions . . . MORRIS Drill Units permit complete automatic control for precise drilling, reaming, tapping, spotfacing and allied operations.

WRITE TODAY FOR DETAILED DESCRIPTIVE BULLETINS

Morris MACHINE TOOL CO.
933 Harriet Street
Cincinnati 3, Ohio

right in tune

...and REX is the standard by which all other high speed steels are compared

A tuning fork sounds the *standard pitch* to which musical instruments are compared. There's a recognized standard for high speed steels, too — Crucible REX®.

But don't take our word for it. Try REX in your own shop. Compare its structure, finish, hardenability, carbide distribution and general uniformity. Measure the *extra performance* you get. You'll see for yourself why no other tool steel outperforms REX . . . why it's the *standard for comparison* wherever high speed steels are used.

Next time you buy tool steels, be sure of top performance — specify REX. Remember, it's made only by Crucible — and is available from local warehouse stocks, or by prompt mill delivery. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Why hats are off to CIMCOOL...

. . . because CIMCOOL® has become, in just a few years, the largest selling cutting fluid in the world. And sales of this radically new and different coolant are continuing to climb because CIMCOOL Standard Concentrate has two big advantages over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We'll be happy to supply information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll have one of our Cincinnati Milling-trained machinists call on you —without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive** — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

CINCINNATI RIGID SHAPERS

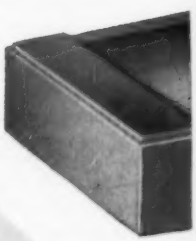
New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

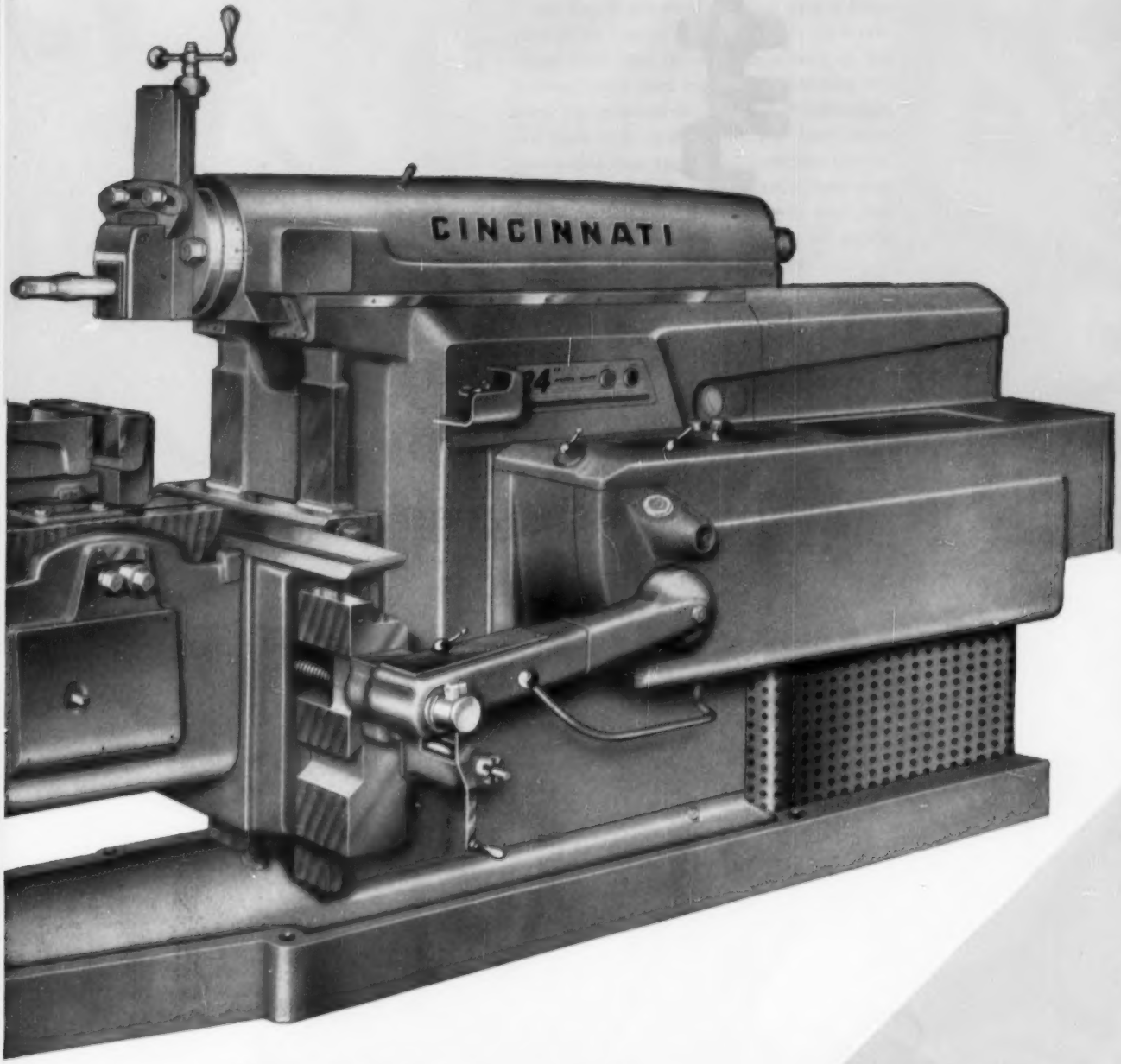
Write for the circular on the New Rigid Shapers.



Nodular iron, slot-free ram

Electro-magnetic Clutch and Brake

The only shaper with 50 P.S.I. lubrication



Cincinnati Shapers, Shears and Press Brakes carry a 5 year guarantee on workmanship and material—write for details.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

Mr. Smith goes to Florida

Mr. Smith's books showed an excellent current ratio. His cash position was good; his surplus was substantial. Shortly thereafter, however, he entered a premature retirement.

He had overlooked the fact that a large part of his company's fixed assets were machine tools, and their values shown on his balance sheet were simply bookkeeping entries. Those values didn't reflect obsolescence, nor show how expensive indirect labor, nonproductive floor space and downtime can be.

A closer look at your balance sheet may reveal the wisdom of investing in new production equipment. Its high rate of return makes good balance sheets better.

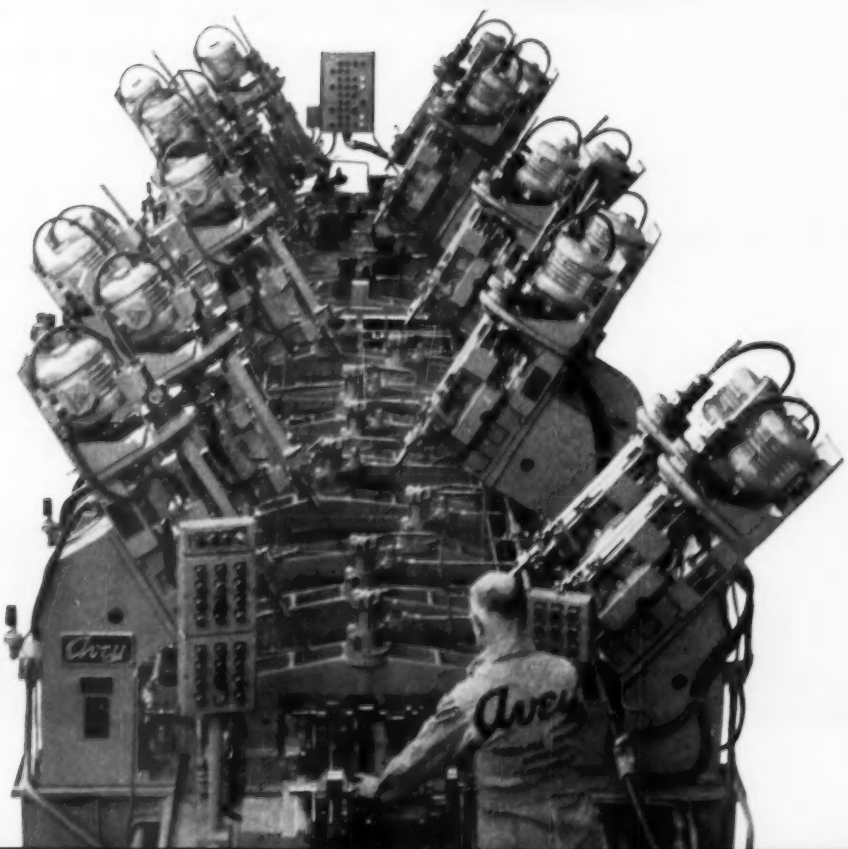
The 14-station machine has Line-O-Dex indexing, automatic hydraulic clamping and positioning, and drills ¼" holes with Aveydraulic Torquematic deep hole drilling units.

When this order is complete, or the part changes in design, the Avey standard units can be rearranged for a new job ▶*an economical way to extend the life of your investment.*

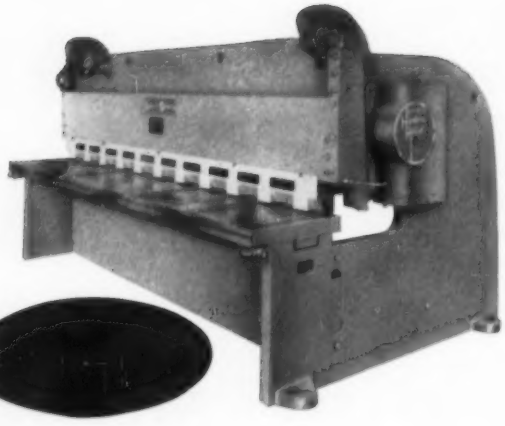
THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

Avey

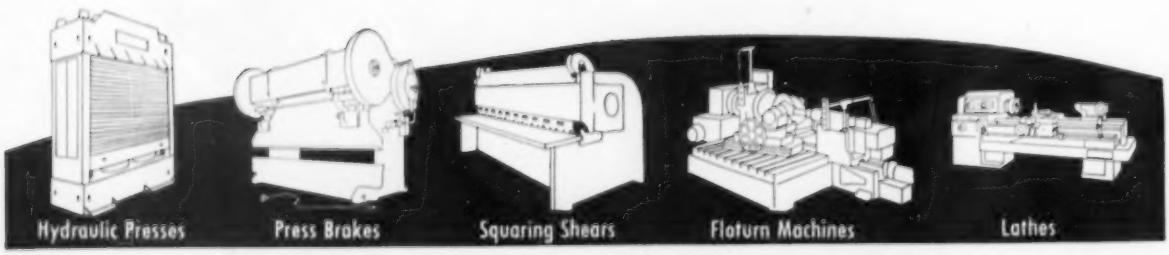


keep your
shear operators in the
production zone



WITH A LODGE & SHIPLEY POWER SQUARING SHEAR

There's one thing for sure about shearing.
Keep the operator out front for maximum production!
That's why one user calls the space in front of his Lodge & Shipley Shear the "Production Zone." With all adjustments in front and all clear behind the shear, the operator stays out front and on top of the shearing job. Necessary adjustments can be made quickly . . . scrap or cut pieces can be removed from the back of the shear by hand, truck or even conveyor.
There are, of course, many other productioneered features in the New Lodge & Shipley Shears. For details, write for Bulletin PS-8:
The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio



DROODLES

by ROGER PRICE

Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

"SLIDE RULE ON A BENDER"

This slide rule served my Uncle George well for years, until he gave up engineering to become a full-time horse player. His frantic efforts to figure an unbeatable system made the slide rule just another sad statistic, for it fell a victim of digit-alis. George's number was up, too, because between his wife and his handicapping, he was finally nagged to death.

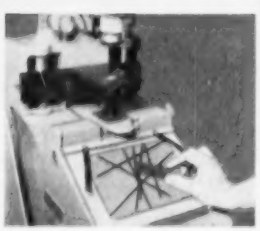
If *you're* being nagged . . . by difficult inspection problems . . . I can put you onto a sure thing. It's the J & L Optical Comparator, a marvelously precise inspection instrument that inspects and measures all sorts of parts and objects, in a range of sizes.

The J & L Comparator spurs production-line inspection, because it's *easy* to operate, is accurate to .0001", and is incredibly flexible and versatile. Eleven models available. Send coupon today for pay-off information.

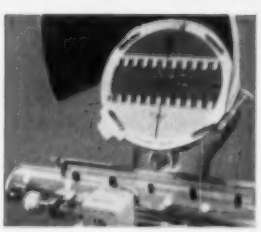
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy to operate

Checking keyway tolerances and hole diameter tolerances, as well as their locations and relationships to one another, in the same operation. Multi-base fixture allows rapid changeover for a variety of parts.



Statistical quality control of glass fibres is easy, using a vertical stage on the J & L Comparator. With 250X magnification, .001" shows as ¼" on the screen, and .0001" as .025". Each fibre is measured instantly to .0001".



Long racks or slotted bars are accurately inspected with the Adjacent Reticle Fixture. A precise scribed glass reticle provides rapid lateral indexing. Tolerance lines on the chart indicate variations in individual dimensions.

J&L JONES & LAMSON

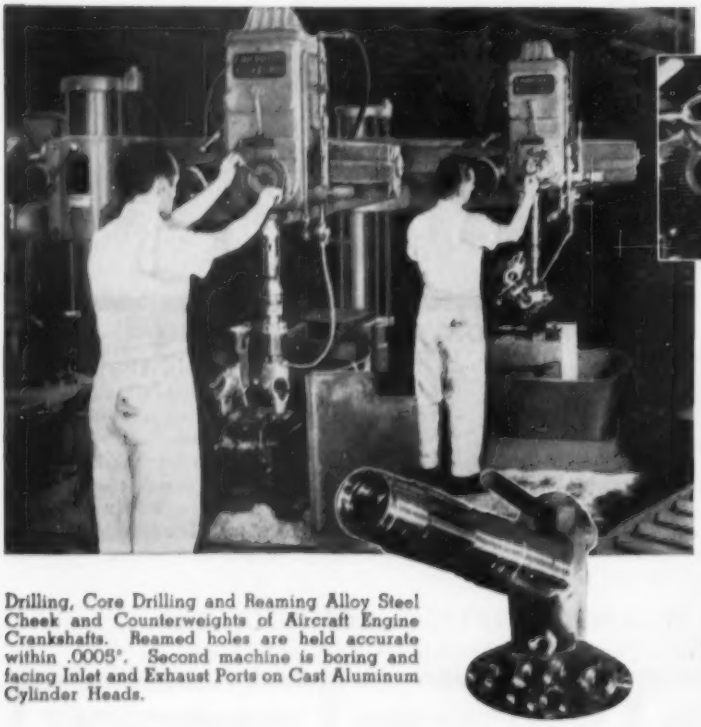
JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vermont, U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete J&L line of optical comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

Cincinnati Bickford MEETS ALL REQUIREMENTS AT Canadian Pratt & Whitney Aircraft Company LIMITED



Drilling, Core Drilling and Reaming Alloy Steel Cheek and Counterweights of Aircraft Engine Crankshafts. Reamed holes are held accurate within .0005". Second machine is boring and facing Inlet and Exhaust Ports on Cast Aluminum Cylinder Heads.

Six Cincinnati Bickford 9" column Super Service Radial Drills have given a fine performance and established a record for accuracy and reliability, and have met production problems at Canadian Pratt & Whitney Aircraft Co., Ltd. Modern Cincinnati Bickford features for convenient easy handling, power and speed have made these machines highly profitable. Investigate these money makers.

Write for Bulletin R 21C.

Photos courtesy of Canadian Pratt & Whitney Aircraft Co., Ltd., Montreal, Canada.

Drilling, Counterboring, Reaming and Tapping 1¾" Hole in Aluminum Crankcase Forging Section to a tolerance of ±.001".

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

Cincinnati 9, Ohio, U.S.A.

GIDDINGS & LEWIS MACHINE TOOL CO. : Fond Du Lac, Wisconsin

G.E. Announces New Induction Heaters

COMPARE THESE PRACTICAL DESIGN FEATURES

DESIGN FEATURES	G.E.	Mfg A	Mfg B	Mfg C	Mfg D	Mfg E	Mfg F
High KVA Oscillator	✓	✓	✓		✓		
Built-in Water-to-air Heat Exchanger	✓						
Readily Accessible For Maintenance	✓		✓		✓	✓	✓
Four Models in Each Rating	✓						
Totally Enclosed Aluminum Oscillator Box	✓		✓		✓	✓	✓
Dust-tight Cabinet Construction	✓					✓	
Industrial-type Oscillator Tubes	✓	✓	✓	✓	✓	✓	✓
Filament Voltage Regulation of ±3%	✓		✓		✓	✓	✓
Water Flow Switch to Protect Oscillator Tube	✓			✓	✓	✓	✓
Three Instruments on Control Panel	✓	✓		✓	✓	✓	✓

Annealing, brazing, soldering, or hardening—whatever the job, G.E.'s new line of electronic induction heaters will help you do it faster, more economically. This new line features four models in each of four ratings (7½-, 15-, 25-, 40-kw) to let you pick the model you need—without wasted investment. Compare (left) this partial list of practical design features with six other leading induction manufacturers, and see why—G.E. gives you **MORE KW FOR YOUR HEATING DOLLAR**. For more information, contact your nearby G-E Apparatus Sales Representative.

Section G722-3, General Electric Co., Schenectady 5, New York

FREE—New bulletin "New G-E Induction Heaters" GEA-6388.

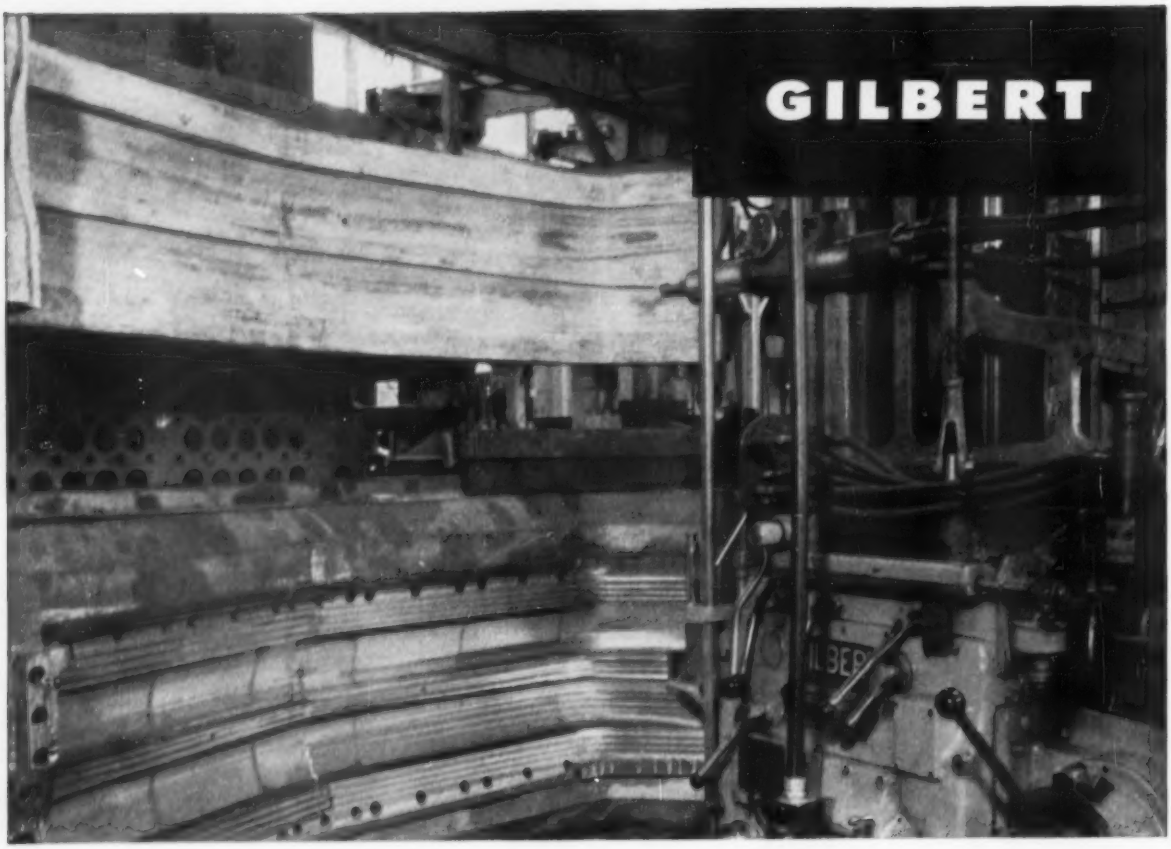
Name _____

Company _____

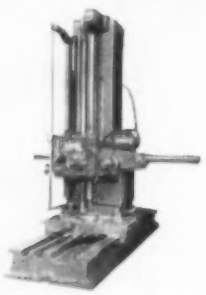
Street _____

City _____ **State** _____

GENERAL ELECTRIC



add reverse curves to your machining pitch



"The Gilbert revolving column boring mills, together with the very accurate Goodrich follower, make possible the machining of deep cavity, steep side dies complete in one position of the work piece.

"It is also possible to machine cupped ends or reverse curves without having to move the job."

These are the words of Mr. Ed Miller, President of the Lansing Tool & Die Company, Lansing, Mich. With his two Cincinnati Gilbert Floor Type boring mills, he has offered customers machining services which couldn't be done on any other horizontal mills. Other equipment capable of doing these jobs costs several times more than the Gilberts.

For profiling and duplicating, a Gilbert offers you quick profits on a low investment. Bulletin 954 contains full descriptions and specifications. Write for it today. *The Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.*

You can buy a new Gilbert floor type horizontal boring mill with 60" vertical and 72" horizontal travel on a 5-year payment plan for as little as $1040 down and $303.50 a month. This is 91c an hour on a two 8-hour-shift operation. Includes low 6% simple interest (3% add on).

those who buy Gilbert buy **GILBERT** *again*

TAPS • DIES • SCREW PLATES • GAGES

GAGES by Card

TAPS by Card

The CARD Quality

Behind the manufacture of Card gages is specialized experience for over 80 years in producing the world-famous Card line of precision taps and dies. When you specify Taps, Dies or Gages by Card, you can be certain that you'll get top performance at low cost.

Presenting the Symbol of Service

YOUR CARD DISTRIBUTOR

S.W. CARD MANUFACTURING CO.

MANSFIELD • MASSACHUSETTS

Division of: UNION TWIST DRILL COMPANY

TAPS • DIES • SCREW PLATES • GAGES

Another example

W-1138

W 1139

# of Blanchard versatility

No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

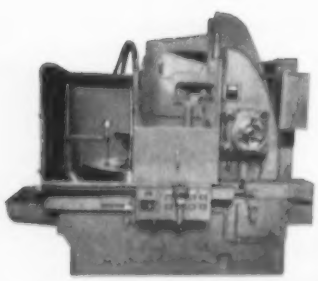
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

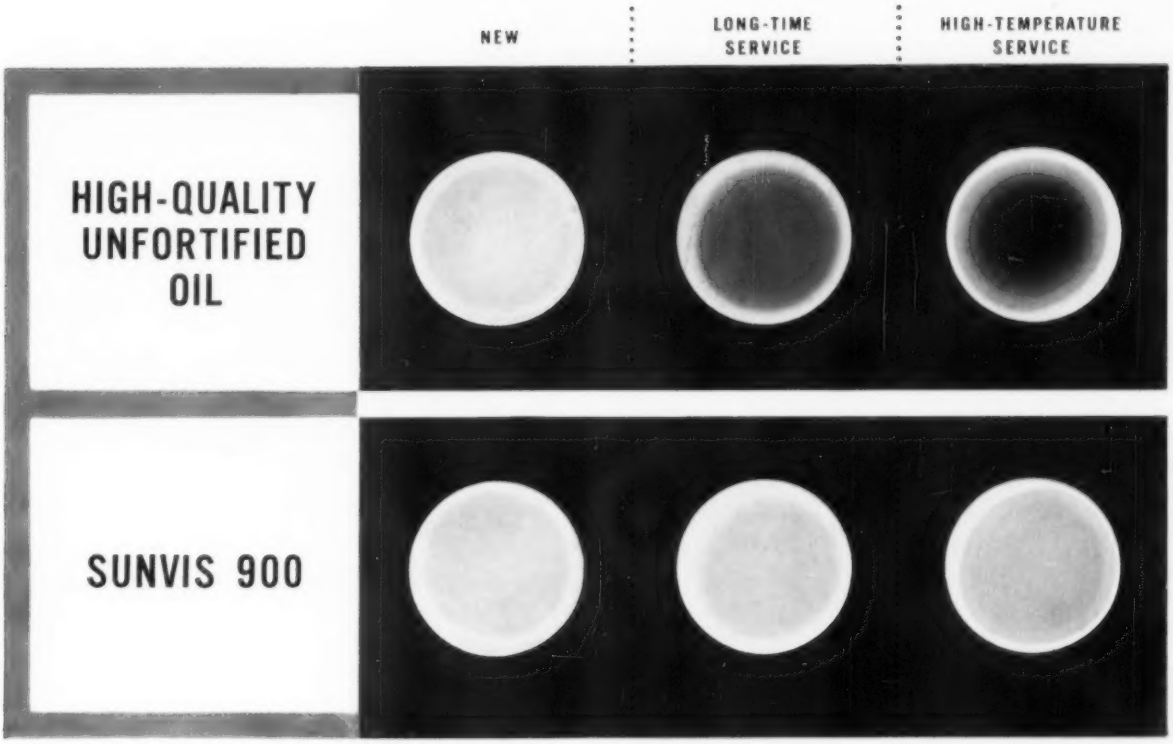
As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!



Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**



Oil color tests show

WHY SUNVIS 900 OILS SAVE YOU MONEY IN CIRCULATING AND HYDRAULIC SYSTEMS

Color means very little in brand new oils. But...color *change* during service can mean a lot. While minor darkening is seldom serious, radical color changes indicate danger, except, perhaps, in a highly detergent oil.

Either the oil is contaminated by foreign matter, or as in the pictures, the oil has oxidized from heat and long use. The products of oxidation darken the color of ordinary oils...clog valves and filters, cause excessive maintenance.

Compare the appearance of the used Sunvis 900 with the appearance of the other used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

Here's proof that Sunvis 900 oils will last longer and provide the extra needed resistance against the high temperature "hot-spots" of typical hydraulic and circulating systems. *For the long run, a Sunvis 900 oil is the most economical oil you can buy.*

For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-31.

INDUSTRIAL PRODUCTS DEPARTMENT

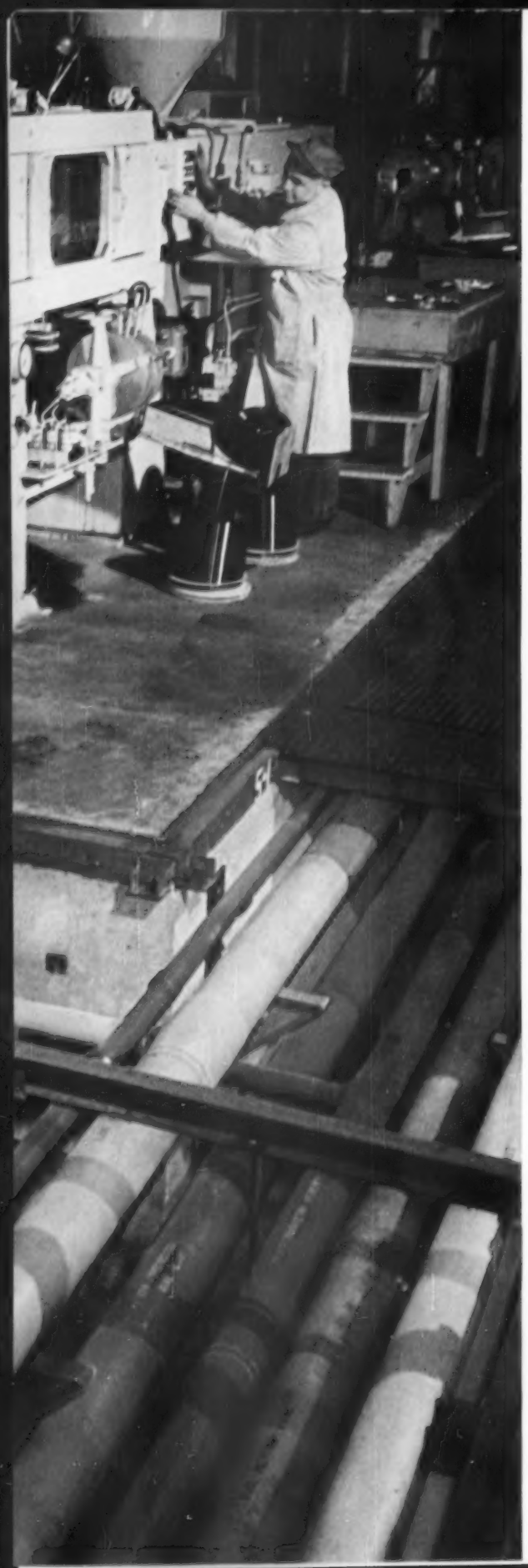
SUN OIL COMPANY

Philadelphia 3, Pa.

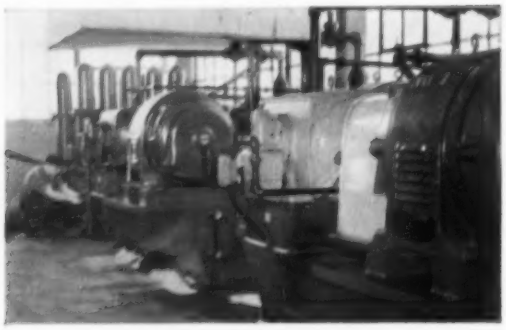
© SUN OIL CO.

In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO



High-Pressure Pumps, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

This is just part of the story about Sunvis 900 oils. Why not talk them over with your Sun representative the next time he calls. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-32.

SUNOCO

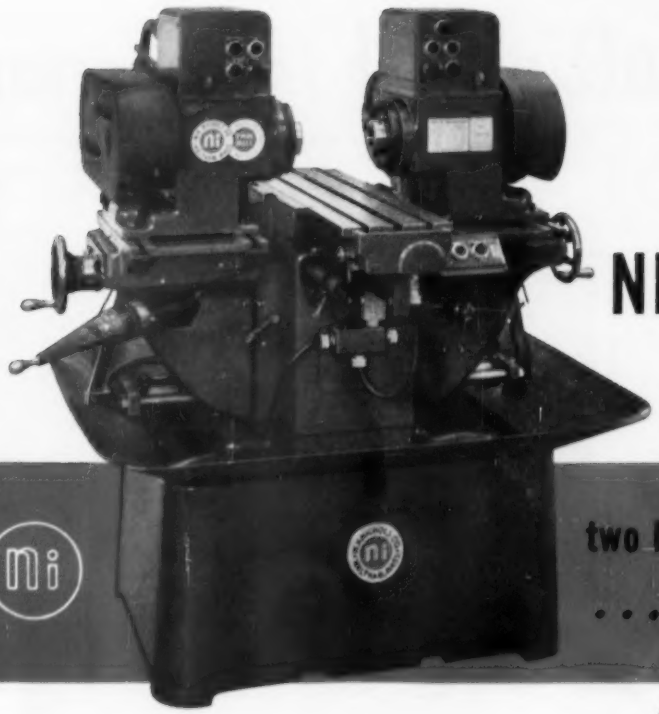
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

© SUN OIL CO.

Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal



NICHOLS TWIN MILL

two heads are better than one

. . . . for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using **horizontal or vertical spindles.**

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

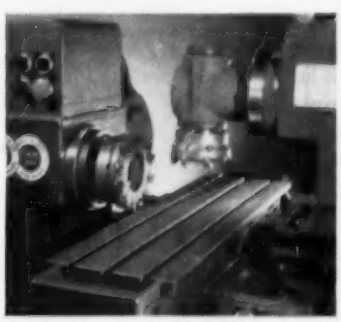
The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

CONDENSED SPECIFICATIONS

Table, working surface	8⅝" x 30"
Table Travel—cutting stroke	11¾"
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11¾"
Max. offset of spindles (horizontal)	8½"
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"

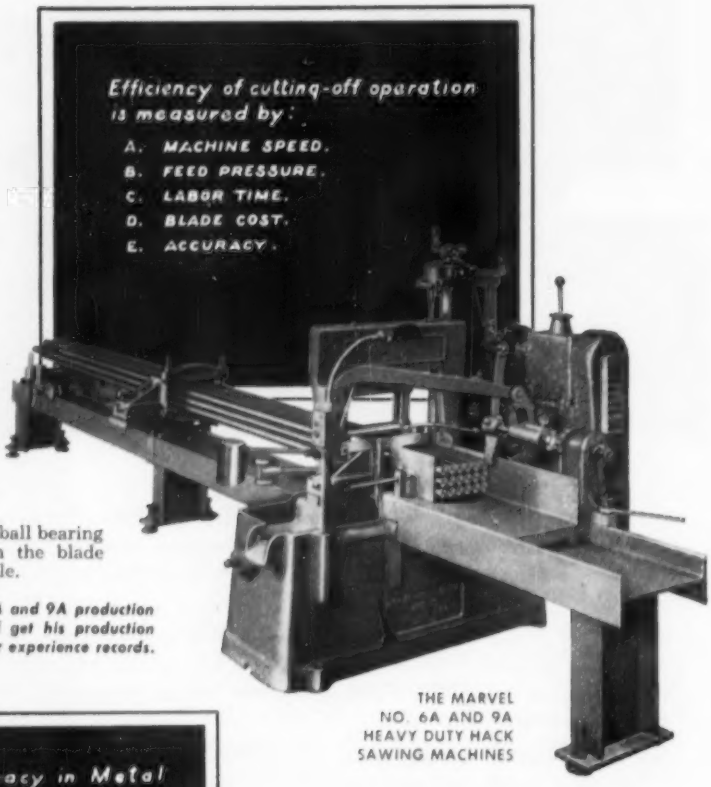


Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

76-F Mamaroneck Ave. NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION** **White Plains, New York**

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack saw blade — the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.

Formula for Accuracy in Metal Sawing:
ACCURACY = (Length, Straightness, Squareness)
(Straightness, Squareness) = (Blade Rigidity, Blade Tautness)
MARVEL
HIGH-SPEED EDGE
ARMSTRONG BLUM MFG. CO.
CHICAGO 22 MADE IN U.S.A.

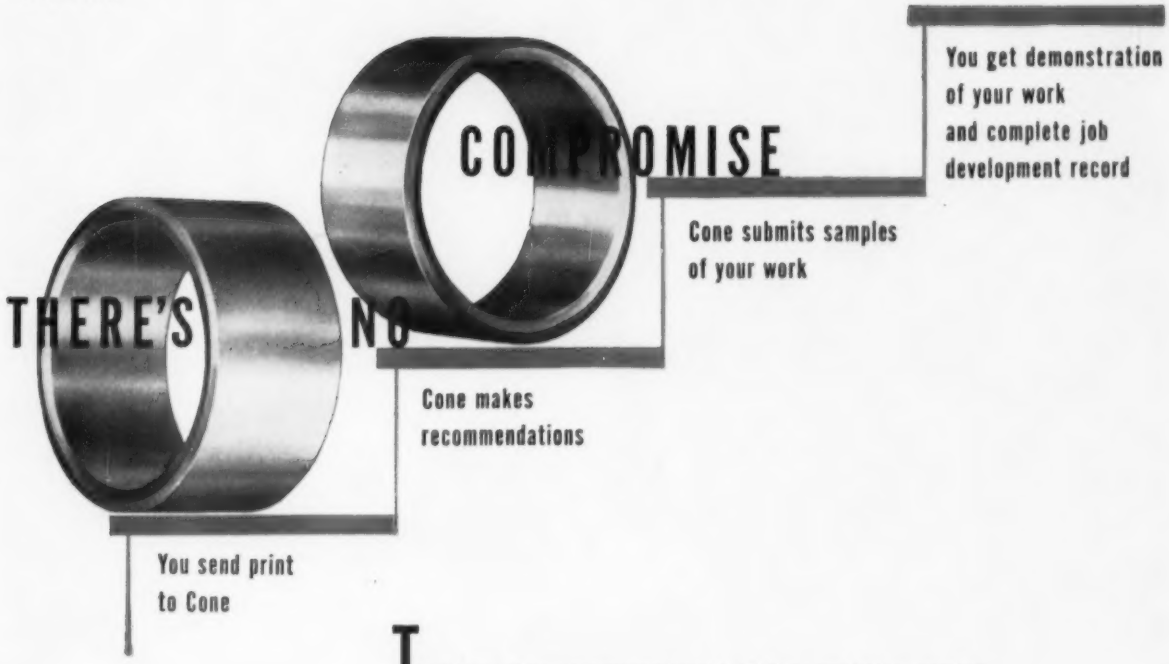
The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

Write for catalog C-55—showing and describing eleven different series of Metal-Cutting Sawing Machines and MARVEL-High-Speed-Edge Hack Saw Blades and Hole Saws.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

No. 6 in a series


THERE'S NO COMPROMISE
You get demonstration of your work and complete job development record
Cone submits samples of your work
Cone makes recommendations
You send print to Cone

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

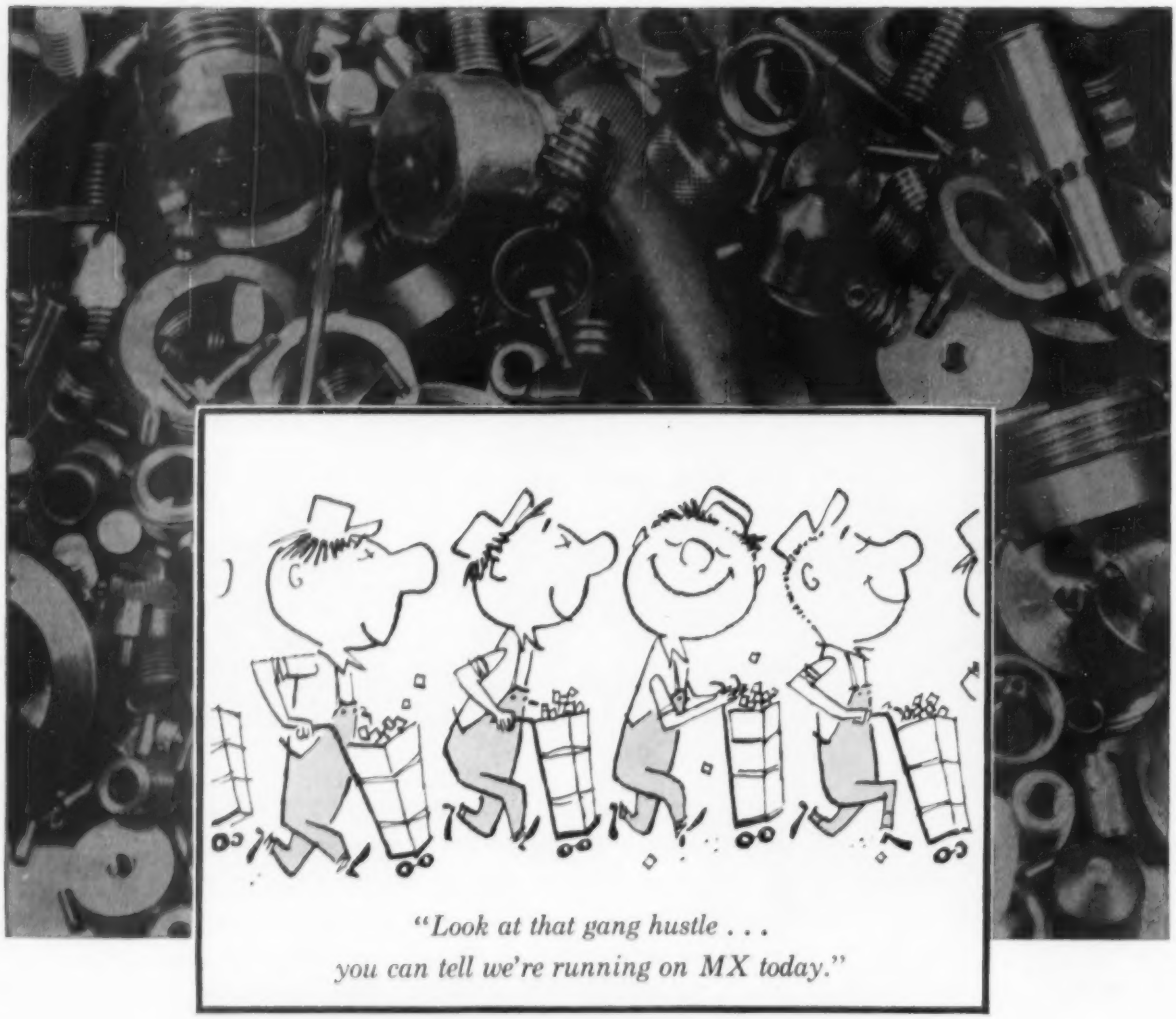
DATA FOR COMPARISON

Part	Bushing	Length	5/8"
Machine	1 5/8" Conomatic	Hole Dia.	1 1/4"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1 5/8"		

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.



"Look at that gang hustle . . .
you can tell we're running on MX today."

You can confidently count on bigger output—more parts per hour—when you put USS Free-machining MX Steel to work.

By making it possible to run at cutting speeds up to 50% higher than normally used with regular Bessemer grades, MX has boosted production in hundreds of shops from 10 to 50%—an average of 40%. And with this easier machining steel, tools have lasted up to 200% longer.

USS Free-machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today . . . yet it costs no more than ordinary screw stock.

Based on the results obtained in producing more than a billion parts of many different kinds and under different conditions, we feel sure that MX will cut the cost of any part you now machine from ordinary screw stock. It does this in four ways.

By increasing the rate of production, *MX lowers the cost per part.* By prolonging tool life, *MX reduces down time.* By assuring better part finish, *MX often eliminates extra finishing operations.* By providing closer dimensional accuracy, *MX helps to minimize rejects.*

Available in both Bessemer and Open-Hearth grades, USS Free-machining MX is produced in all the popular screw stock sizes. It is sold in cold finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our district sales offices.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs

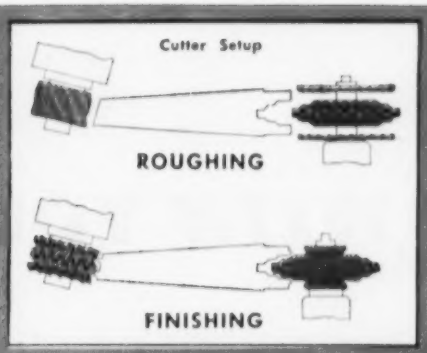
—when you do the job with free-machining MX

USS

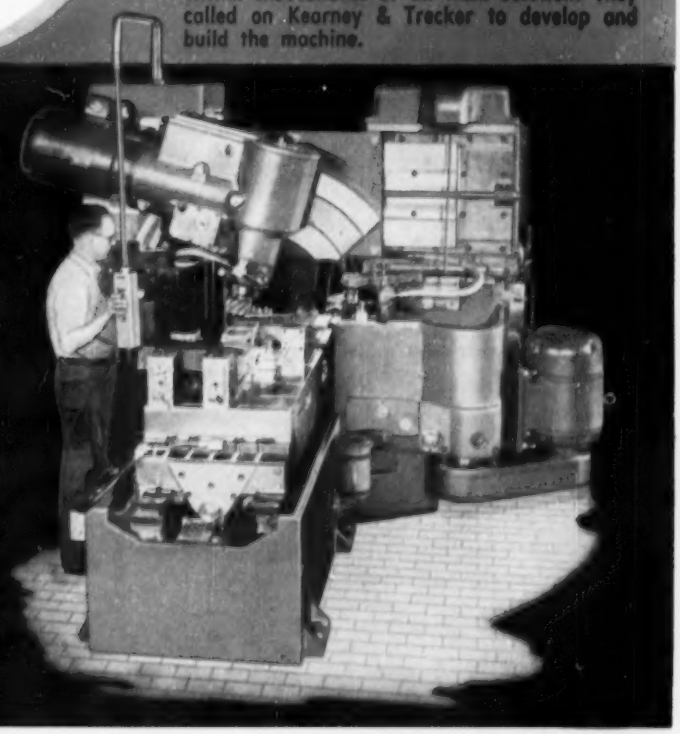
UNITED STATES STEEL

CUSTOMER SPECIFIED

KEARNEY & TRECKER MILWAUKEE DESIGNED



A leading electrical equipment manufacturer needed a production machine to rough-and-finish mill a variety of sizes of chrome-nickel-steel steam turbine blades — 4" to 30" long. Specifications called for a machine that would cut milling costs and maintain accuracies within thousandths of an inch. Solution: They called on Kearney & Trecker to develop and build the machine.



Production rates are dependent upon workpiece size. For example, twenty-seven 13½" chrome-nickel-steel blades are rough-and-finish milled per hour by this new Kearney & Trecker Two-Spindle Bed Type machine.

Rectangular index table with two work-holding fixtures enables the operator to unload and load one fixture while the other is in work. This sequence eliminates down-time and keeps production constant.

Dovetail end of blade is rough-and-finish milled with the lower spindle, using a combination of special form and side mills. Head, mounted in an inverted position on a saddle, is counterweighted. Tenon end of blade is milled with the upper vertical head which moves in an arc on radial ways . . . angular adjustment of 45° is possible.

Other machine features include air-clamping for machine table . . . automatic chip conveyor . . . high volume coolant pump . . . easy to change pick-off gears for each head to select exact desired spindle speeds.

New production efficiency starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most important to you — it's accomplished by combining standard design components with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has the all-around ability to meet your production needs. Take advantage of these abilities. They can pay off in lower machining costs and more profits for you. See your Kearney & Trecker Special Machinery Division representative. He'll be glad to help you with your production requirements. Call him today.

For more details on machine illustrated ask for Data Sheet No. 1067. Booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Special Machinery Division

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Our interest in a Federal Gage doesn't end when we sell it to you. We want you to have the **right** gage and we want to be sure that it performs right on the job.

To give our customers on-the-spot service, we have nine wholly owned Branch Offices located in the principal manufacturing centers of the country. Each has its own Manager and a staff of trained gage engineers who are experienced in the design and use of all modern gages. We also have twenty-one manufacturer's representatives with their staffs, handily located from coast to coast.

Engineers who specialize on certain types of gages travel out from the factory at Providence, analyzing needs, making recommendations and solving problems.

Before you buy a gage, talk over your problem with one of our engineers. He's located nearby and knows what to look for, and what information will be needed by the factory to produce the right gage. **Call him in the early stages** so that you can take advantage of Federal's wide experience. Backed by the very complete Federal line, our engineers can honestly suggest the **best** way to accomplish the inspection needed.

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Such complete follow-through, combined with the most extensive line of gages in the world, means that you get from Federal the **right** gage for your use and can be sure it will give full satisfaction and value on the job.

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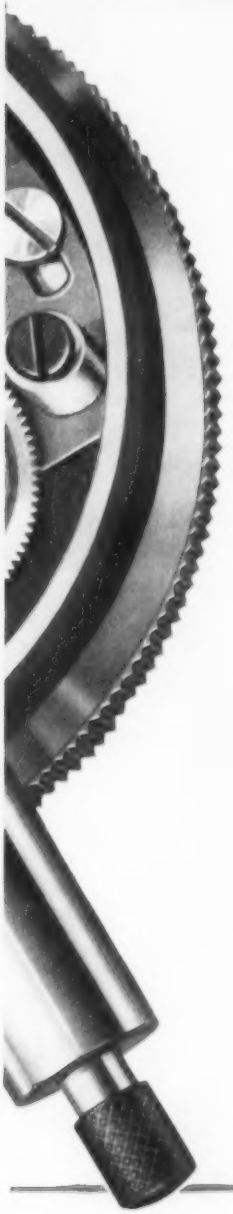
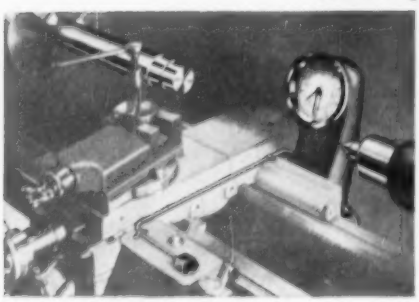


with the maintenance-free "H" Movement

Rugged—shockproof—withstands impact without damage. No cushion movement required. **All gears, racks, and pinions precision hardened** — friction reduced 16% to 25%, depending upon magnification . . . a new high in sensitivity. Calibrated accuracy greatly improved. Off-white dials and fine line graduations facilitate readings. Available in four sizes. Enthusiastically received in shop tests.

Also, a New Machine Tool Gage—the DISTOMETER



Illustrated with tail stock backed off.

A long range indicating device for accurately determining tool position with relation to a predetermined reference. It indicates to the operator (within .0025") when the cutting tool has covered the required distance on the workpiece. Provides much-needed machine control for repeat operations, when roughing down to size, particularly where the tool travel is long. Can be readily located on any machine tool carriage regardless of table travel. It eliminates scrap, increases machine productivity and maintains dimensional quality.

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SEND LETTERS TO:
BACKLASH EDITOR American Machinist
330 W 42nd ST, N Y 36, N Y

Extra Zero

May I call your attention to an error in the caption for the illustration of the Greenerd ring expander (*AM*—Jan 30 '56, p83), wherein you state that rings can be stretched to size within 0.0002 in.? This tolerance should read 0.002 in.

T N Ferren
General Electric Co
West Lynn, Mass

Cash or Dignity

Years ago, when I was just an apprentice, I used to look with envy at the white-collared, black-coated gentlemen on the office staff. I longed for the day when perhaps, by hard work and study, I might become one of them, might move into a "better" neighborhood, wear a clean shirt every day, and create something of a flutter in the hearts of the opposite sex. Well, the opportunity came, and I took it, but now I sometimes wonder, too late, whether I did the right thing.

Last year, a family moved into a new house just down the block from me, and it turned out to be a guy who served his apprenticeship with me. He was not very smart, so he never got the chance I did, and he is still only a machinist today. But the house cost $20,000 if it cost a penny. Mine cost $5000 fifteen years ago, and I had a tough time paying for it. He drives a brand new 1956 Mercury; I still have my 1950 Ford. His house has a built-in automatic washer, drier, and dishwasher; my wife dries her clothes on the line, weather permitting, and she and I do the dishes.

He kids me about being an executive and "wishes he had my dough." But he goes to work in coveralls that he changes once a week; I have to be "properly" dressed every day. He gets three years of wear from a suit because he wears it only in his leisure time; I am lucky to get one year because I have to wear it every day and must not let it get too shabby. Even in the hottest weather I am not permitted to wear slacks and a sport shirt to the office because it would not be dignified; he can wear anything he pleases.

He is a good Joe, he takes me fishing in his motor boat; I've never been able to afford one. He has the finest

GRINETICS

By D G SMITH

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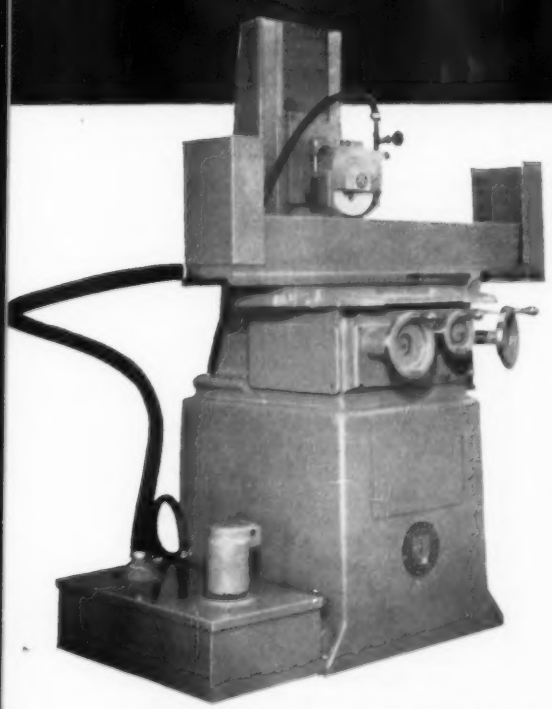
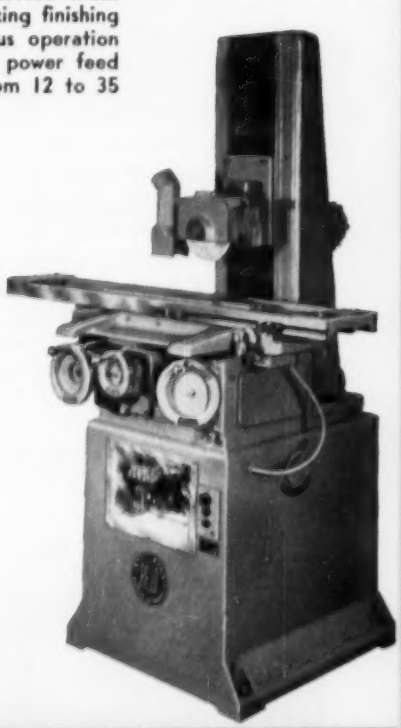
REID sets the standard for precision surface grinding...



MODEL 618H convenient finger-tip level controls for all operations make this grinder the favorite of the toolroom for the finest tool and die grinding. Accessories, including Cool-Grind or wet grinding attachments, magnetic chucks and form dressers give extreme versatility for all operations.

MODEL 618VL designed for precision grinding to the finest tolerances with superior surface finish . . . rugged construction and painstaking finishing give true dependability for continuous operation with minimum maintenance. Features power feed table with traverse speed variable from 12 to 35 feet per minute.

Photo courtesy of Robertson Mfg., Co



SPECIFICATIONS

CAPACITY: 6" wide, 18" long, 17¼" high from spindle center to table.
WORKTABLE: 51" x 8" overall.
FEED RANGE: Elevating hand wheel (r.) graduated to .0005" (optional, vernier to .0001"); cross feed to .001"; power cross feed adjustable .006" to .100" at either or both ends of table reverse.
GRINDING HEAD: with 3" opening for standard 1 h.p. cartridge type motorized spindle. Wheel size: 7" x ½" x 1¼".
FLOOR SPACE: 71" x 43½"
WEIGHT: 2100 lbs. net

Write for Bulletin 618-1

Reid Brothers Company, Inc.
BEVERLY MASSACHUSETTS

Automation

IN MARKING

MARKS 7500 PIECES PER HOUR

Capable of speed-marking 7500 parts per hour, this hopper and dial feed machine is just about the nearest thing to automation in marking. As illustrated above, Model 435 features a vibratory parts feeder, 30″ bowl and a dual track carrier. Parts are fed to the machine from the bowl, then permanently marked and automatically ejected. Spring pressure controls depth of mark and insures clear uniform imprint. Ideal for speed-marking solid, round, heavy walled or conical parts. Like all Noblewest Roll Marking equipment, it produces permanent deep impressions . . . good for the life of your product . . . at *faster speed and lower cost.* For detailed information write Noble & Westbrook Mfg. Co., 17 Westbrook St., East Hartford 8, Connecticut.

Noblewest is equally famed for its fine marking dies.

MARK IT BEST WITH

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MARKING MACHINES • MARKING TOOLS

of tackle, and his hunting equipment is out of this world; I'm still using a rod and gun my father had. He has three youngsters, the oldest just starting at an Ivy League college; I have one who was lucky enough to get a scholarship at a small college—otherwise it would have been a tough struggle to put him through.

I must admit that, for the record, I make a little more money than he does; but he gets the same paid vacation and holidays that I get, and he gets overtime pay for every extra hour he works, and that's plenty. Yet I often put in longer hours than him, and get nothing for it. When they pass the hat for a charity or a gift, he's not expected to give more than a quarter; I can't get away with less than a dollar. If the cost of living goes up, his pay is adjusted accordingly; mine stays put. Yet we both pay the same for a loaf of bread.

If I pull a boner in my work, I've got to straighten it out no matter how long it takes, and I may well be fired for it. If he scraps a piece of work, that may cost the company far more money, his Union will see that he is not penalized for an "honest" mistake, and he may even be paid time-and-a-half to do it over.

I'm not complaining of his good fortune, but I do feel that industry should give more thought to the situation of the modern "wage-slave"—the white-collar man. If we must "maintain our dignity," then at least give us the wherewithal.

Robert McClellan
Cincinnati

Change the Training

We keep hearing so much these days about the shortage of engineers that I wonder if we are not trying to teach our engineering students too much. The standard four-year college course is no longer sufficient to cover the wide field of instruction they must have, and even after five years they are still far from being really capable men. Should we not be much better off if engineering students were permitted to specialize in their first year of college?

Admittedly there are certain basic subjects they must all have, such as mathematics, strength of materials, and so on. But why waste so much time on non-essentials? If a boy is going into aeronautical engineering, why spend time filling his brain with the operation of steam engines and the theory of steam? A fully rounded engineering education is a wonderful thing, but only very few ever need it. Most young men confine them-

selves to a narrow, limited field after they are out of school, and if they want to broaden it they can do so in night classes while still contributing to industry's needs during the day.

Recently, a number of people have "viewed with alarm" the huge number of engineers turned out by the Russian schools each year. I cannot speak from personal knowledge, of course, but I strongly suspect that the Russians must be thinking along similar lines to myself.* I doubt whether all these Russian engineers are fully trained in the American way. Instead, I suspect they are highly trained, and very efficient, specialists in one particular field. In the unlikely event that, say, a machine tool designer encounters a problem in steam expansion, it is far more efficient for him to turn that phase of the problem over to a steam specialist than to spend hours vaguely trying to remember something about the subject that he learned in his first or second year at school and then probably getting it wrong.

I am not criticizing the schools so much as the outdated requirements of State licensing boards. A hundred years ago, an engineer was a rare bird who had to be equally at home running a steam plant, building a bridge, or designing a lathe. That need no longer exists. This is an age of specialization, and licensing requirements should be tailored to suit. We do not exepct an airplane pilot to be able to run a railroad locomotive; but we expect the same engineer to be able to design both. If a bomber pilot wants to fly jet fighters, he can take special training, pass an examination, and be so licensed. Why can't engineers do the same thing?

Charles Whitelaw
Chicago

Big, But Good

General Electric's idea of using massive machines for making tiny parts (*AM*—Feb 13 '56, p139) strikes me as being revolutionary. One would normally expect little parts to be made on little machines like jeweler's lathes and similar miniature equipment. It makes good sense, of course. You can be sure of the spindles not being affected by the resistance of the work, and there sure isn't going to be any deflection in the base, caused by the weight of the part. But I think the most remarkable angle is that the machine builders are able to build in such extreme accuracy in spite of the large size.

Thomas A Caldwell
Brooklyn, NY

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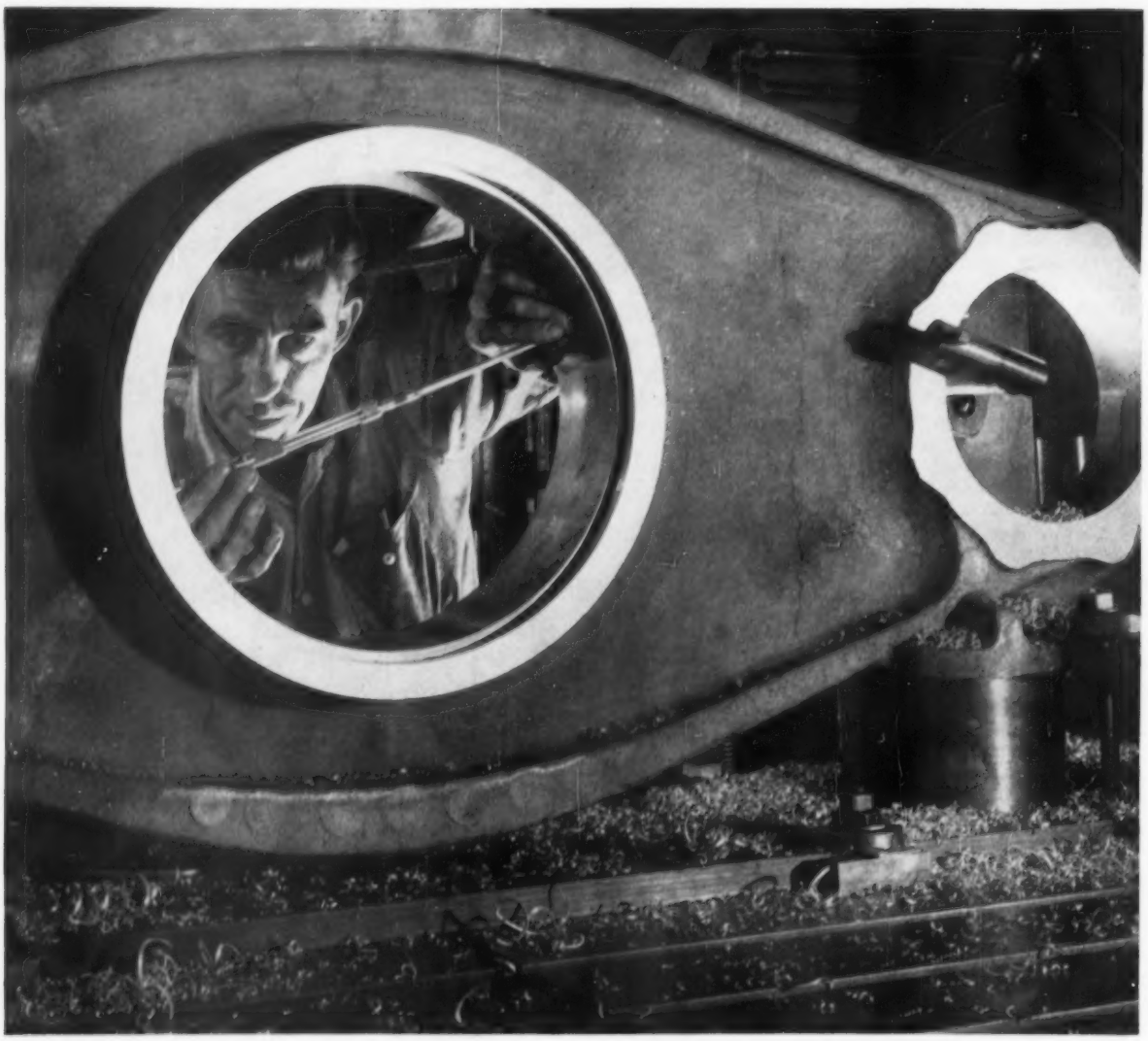

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But why stop with measuring tools when there are so many opportunities to get the same quality and dependability in so many other Starrett products? Did you know, for example, that Starrett makes the world's most complete line of dial indicators and dial gages? Or that Starrett is among the largest producers of hack-saws, hole saws, band saws and band knives? Or that Starrett makes precision ground die and flat stock in over 1000 sizes?

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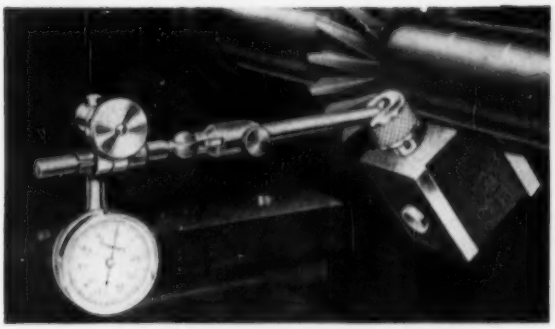

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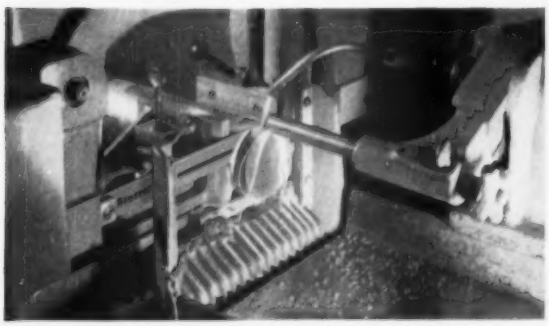

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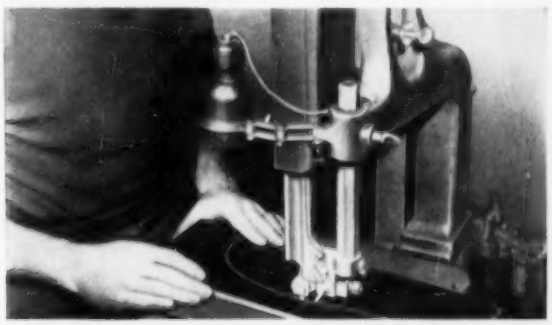

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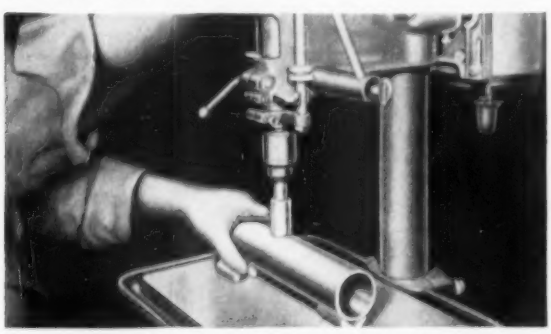

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Use these new double-welded, shatterproof hole saws for cutting large diameter holes in metal, plastic, wood. Interchangeable arbors hold a wide range of saw sizes. Shanks fit portable power tools, lathes, drill presses, etc.

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Spot News of Metalworking . . .

- **Pool order contracts for some $200 million machine tools,** to be activated instantly in a national emergency, are now being placed with builders by General Services Administration. This so-called "trigger' program is backed by $22 million earmarked funds, taken with ODM blessings, from Defense Production Borrowing Authority money.

- **Twelve small businesses have pooled their facilities** to bid on defense contracts at Huntington, W Va. With a total employment of 1881 people, they seek contracts to make optical and electrical equipment, fabricate steel.

At least two major aircraft companies have launched intensive research into percussion (fast, sharp blows) forging and forming. Object is to form impossible-to-form alloys of Ti and stainless.

- **Air Force has a new way of disposing of excess special tooling.** Contractor notifies the Air Force 6 to 12 months ahead when his contract will phase out. AF then figures whether the tooling can be used on other defense projects. If not, it is either mothballed or sold off.

- **Add to the now-you-can-lease-it:** X-ray equipment and standard industrial instruments in $2500-$50,000 orders from North American Philips Co. Rental is 3¼% of cost for the first year, drops ¼% per year for five years.

- **Norwegian government has hired U S personnel consultant George Kenning** to spend 90 days in its major plants. His job is to staff a dozen or more plants with local people, then get a U S-like personnel setup into operation in each one — all in three month's time.

- **Rectangular-shaped motors that take up less space but have the same output** as conventional round motors are being marketed by Leece-Neville Co, Cleveland. They come in 6, 12, 24 and 32-volt ranges with outputs to 140 oz in. Initial applications will be in autos and trucks for powering window regulators, seat adjusters, air conditioners, and other limited-space applications.

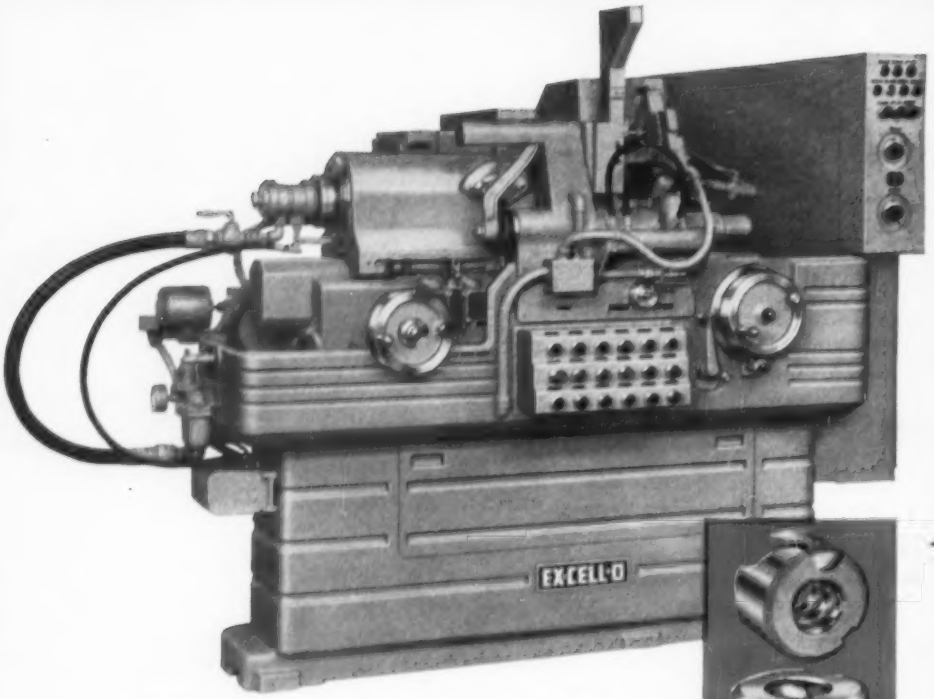
Heavy-gage stampings are replacing castings on some appliances and air-conditioning equipment. To handle formed and drawn parts in 16-gage to ⅜-in. plate, one contract stamper has set up a shop wherein a master control board programs the equipment, minimizing handling costs and speeding up production.

- **Manufacturing is attracting more engineering graduates than research** or design, according to an American Society of Tool Engineers survey, that shows manufacturing has a 50% edge over design, 100% over research.

- **A wartime-like scrap campaign may be in the offing** if we don't cut scrap iron and steel exports. That's the prediction of Cleveland's ferrous foundrymen, despite government "situation under control" assurances.

- **Regularized replacement of old production equipment with new** will be the subject of the Second Annual Seminar in Dynamic Equipment Policy at Beloit College, Beloit, Wis, this summer. Sponsor is Machinery & Allied Products Institute.

- **High production costs, and difficulty in getting materials and parts on time,** stemming from Western Europe's current boom, have led one U S machinery producer to cancel his arrangement for having his machines built on contract by a European manufacturer.



Ex-Cell-O Style 39-A Precision Internal Thread Grinder equipped with automatic work handling equipment. This machine loads, locates, grinds threads and ejects steering gear ball nuts in a completely automatic cycle.

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Thread Grinders
Manual – Automatic – Automated

EX-CELL-O STYLE 33 FOR EXTERNAL THREADS: An accurate production machine, automatic except for loading, unloading, and moving the cycle lever. Can be arranged for tapered grinding and for eccentric relief grinding.

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EX-CELL-O STYLE 50: A versatile machine for external work . . . also available with internal attachment.

EX-CELL-O STYLE 120: Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

These standard machines are grinding thread gages, machine tool lead screws, innumerable aircraft parts, automotive steering mechanisms and pinions, worms, taps, and many similar workpieces.

Precision thread grinders in this Ex-Cell-O line range from manually-operated models, for toolroom and for short runs, to high production automatics, to styles equipped with automatic work handling equipment. There are five models designed to meet your every requirement.

For specific information on thread grinder operations or a quotation on a machine for your requirements, call your local Ex-Cell-O representative or write Ex-Cell-O in Detroit.

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56-5

XLO

EX-CELL-O for PRECISION

Washington . . .

Symington launches airpower probe . . .

The highly touted Senate probe into the administration's airpower policies gets under way next month. It's being run by a Senate Armed Services Subcommittee headed by former Air Force Secretary Symington, now Democratic Senator from Missouri and one of the most vocal critics of the Eisenhower defense program.

Symington plans a full-dress, open investigation of the program—the first of its kind since defense began shaping up as a big political issue. It has the makings of becoming one of the most important Congressional probes of the year. It comes on the heels of a running squabble between Democratic military policy spokesmen and the Republican administration. The charges are that the U S lags behind the Russians in developing long-range ballistic missiles and producing jet aircraft. This lag, according to the charge, stems mainly from the administration's fiscal policy.

Symington's strategy is to get Pentagon brass to testify under oath on their appraisal of U S-Russian airpower—not like in appropriation hearings, where they are under the gun to support the administration program.

He figures he can build up a record to show that the administration's talk of how we will stack up on airpower with the Russians is blown up. Later, as a climax, Defense Secretary Wilson is likely to be put on the griddle to try to prove the influence of fiscal policies in the defense program.

What will come of all this? Airpower partisans are looking for a hike in new money and an added push for the Ballistic Missile Program. The Democrats, of course, look for some political capital.

Army loses fight for transports . . .

The Joint Chiefs of Staff have turned thumbs down on the Army's demand for more long-range air transport planes. The Army wanted to make more of its divisions airborne, was pushing for a step-up in the Air Force's troop-carrier forces. One of the big factors in the decision: the vulnerability of overseas air bases needed for initial landings of the transports. Says a top-level Pentagon official: "Overzealous people have oversold us on this thing. But it's not in the cards to haul large bodies of troops long distances."

Military reserves and employers . . .

The Defense Dept will honor Norton Co, Worcester, Mass, and Bell Aircraft Corp, Niagara Falls, N Y, for setting up exemplary military reserve leave policies for employees. They are the first companies cited under the Pentagon's new campaign to drum up industry cooperation with the Military Reserve Program.

The program now requires most men who complete active service to take part in reserve training drills for periods up to 7½ years. The provisions pose a host of new problems for employers: Do you give regular vacations to reservists on top of military leave? Do you pay them while they're training?

Meantime, the Pentagon is having trouble with one of its biggest guided missile contractors. The firm refuses to hire military reservists, claims its production would be upset by workers taking off on two-to-four-week leaves for military training.

Firming up the Red tool embargo . . .

The U S went along with demands by its NATO allies to relax trade restrictions with the Soviet bloc, Commerce Secretary Weeks tells Senate probers, because the West Europeans were sorely pressed for new markets. The Senate Investigations Subcommittee is studying effects of the 1954 agreement between the U S and its allies to soften the embargo on strategic goods — notably machine tools — shipped behind the Iron Curtain. Subcommittee Chairman McClellan threatens to hold up new foreign aid appropriations because of the embargo easing.

House to look at consent decrees . . .

Democrats will probe Republican emphasis on settling big antitrust cases out of court by consent decrees.

Rep James Roosevelt (D-Cal) and a House Small Business subcommittee plan hearings on certain consent degrees, to see if big companies are getting off too easy, and if small firms are being adequately protected by consent decree agreements.

Complaints by small businessmen that their problems are too often overlooked when the government signs such decrees will be aired. And possible legislation to amend the antitrust laws—to make consent decrees tougher and to use them as evidence in private antitrust triple damage suits—will also get consideration.

Selling to the government . . .

Two new booklets are out telling metalworking firms how to sell to the government. *"Pointers on Government Contractors"* is available free from the Small Business Administration, Washington, D C, explains government buying methods, tells how to get information on prime contracts and subcontract opportunities, and gives suggestions on how to prepare bids and purchase proposals. *"Selling to Navy Prime Contractors,"* available free from the office of Naval Material, Navy Dept, Washington, D C, lists nearly 500 primes, tells how to land work from them.

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Simple Simon met a dieman
known throughout the trade;
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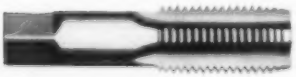

BAY STATE TAP & DIE COMPANY
MANSFIELD, MASSACHUSETTS

Detroit . . .

Look for a new Packard series . . .

A while back, Studebaker-Packard announced, or rather implied, it is coming out with a "new product,' which can only mean a new car.

A little judicious inquiry reveals that the new series will bear the "Packard" nameplate, and that it will fall between the Packard and the Clipper. Price-wise, it'll hit the market at around $3500 FOB Detroit.

It will be a "Packardized Clipper"—a car built on the Clipper shell, but with Packard components to give it a Packard front and rear look. The interior will be lush, if not identical then very much like that of the Packard. It'll have a Clipper engine.

Packard won't retool to any great extent to bring the new series to market in the spring. Checks around the tooling circuit make it pretty certain that production will be limited until Packard probes the sales acceptance of the new job.

Those in the auto know say the new series may be just a sales gimmick, figuring that Packard can turn out the new car with a minimum of tooling, and can afford to drop it in a year or two if it fizzles.

Detroit tooling people think Packard has delayed so long on its decision to produce a new line of cars for '57 that it's extremely doubtful now whether the company can break with new models before December. This would mean trailing the rest of the industry in new model introductions—something that can hurt, saleswise.

So far, Packard acts as if the new model will be potent competition for Chrysler Windsor class cars.

If it doesn't turn out that way, you can look for Packard to drop the new series—fast.

Safety gadgets sales boom . . .

The swingover toward auto safety equipment is doing just fine saleswise. Ford, which hung much of its sales pitch for '56 model sales on safety, reports that fully 8% of the buyers of new Fords are ordering factory-installed seat belts—a percentage that has held up ever since their introduction last October.

Padded sun visors and dashboards hit a 30%-of-all-Fords sales level through January, then in February jumped up to 48%.

Ford sales people figure the demand for seat belts will stay pretty close to the 8% mark, but they think demand for padded dashboards and sun visors will hit 45% for the rest of this year.

Power brakes are a getting a big play, too, throughout the industry. Latest figures show they're being installed on 22.3% of all new cars.

You'll see "quadruple headlights" on most cars in the not-too-distant future. But the automakers face a lot of state legislation before they can make the headlights standard, or optional, items.

New brake design will change wheels . . .

GM's Firebird brakes, all-metal ones that supposedly pick up friction efficiency as induced temperatures rise, may well be on all GM cars within the next few years. Broad-scale adaptation will mean radical changes in wheel design. On the Firebird, magnesium wheels are a full seven inches deep, and have no dropped center rims.

Although precise details on the new brake haven't been released yet, a close examination of the Firebird shows two wheel cylinders per wheel instead of the usual one. And though GM won't confirm nor deny, there's little doubt that the friction pads are made from powdered metal.

New site for Auto Show?

A new site for an all-industry Auto Show has been rumored around Detroit for some time. General Motors, the reported holdout, has evidently indicated it will go along with the idea, with the Show to be held in New York City each fall.

GM will not, however, show its dream cars, its kitchens of the future, or movies and such.

GM will save that for its Motorama. The all-industry show will show off standard GM models.

Easier breathing on Auto Row . . .

The collective worry warts of Auto Row let out their collective pent-up breath with a mighty whoosh recently. The reason: February car sales picked up a full 6% over January, and dealers are looking for a significant inventory reduction in March.

February sales are reported at about 513,000, compared with 560,000 in February 1955. Most of the industry believes first quarter sales will be down 10 to 13% from first quarter 1955's total of 1,770,000 units.

Ford to host college profs . . .

Ford Motor Co is bringing 37 college professors to its Dearborn plant for its second annual Ford Educational Forum. The savants will study organization and administration, employee relations, marketing, mass production, economics and public relations in the auto industry.

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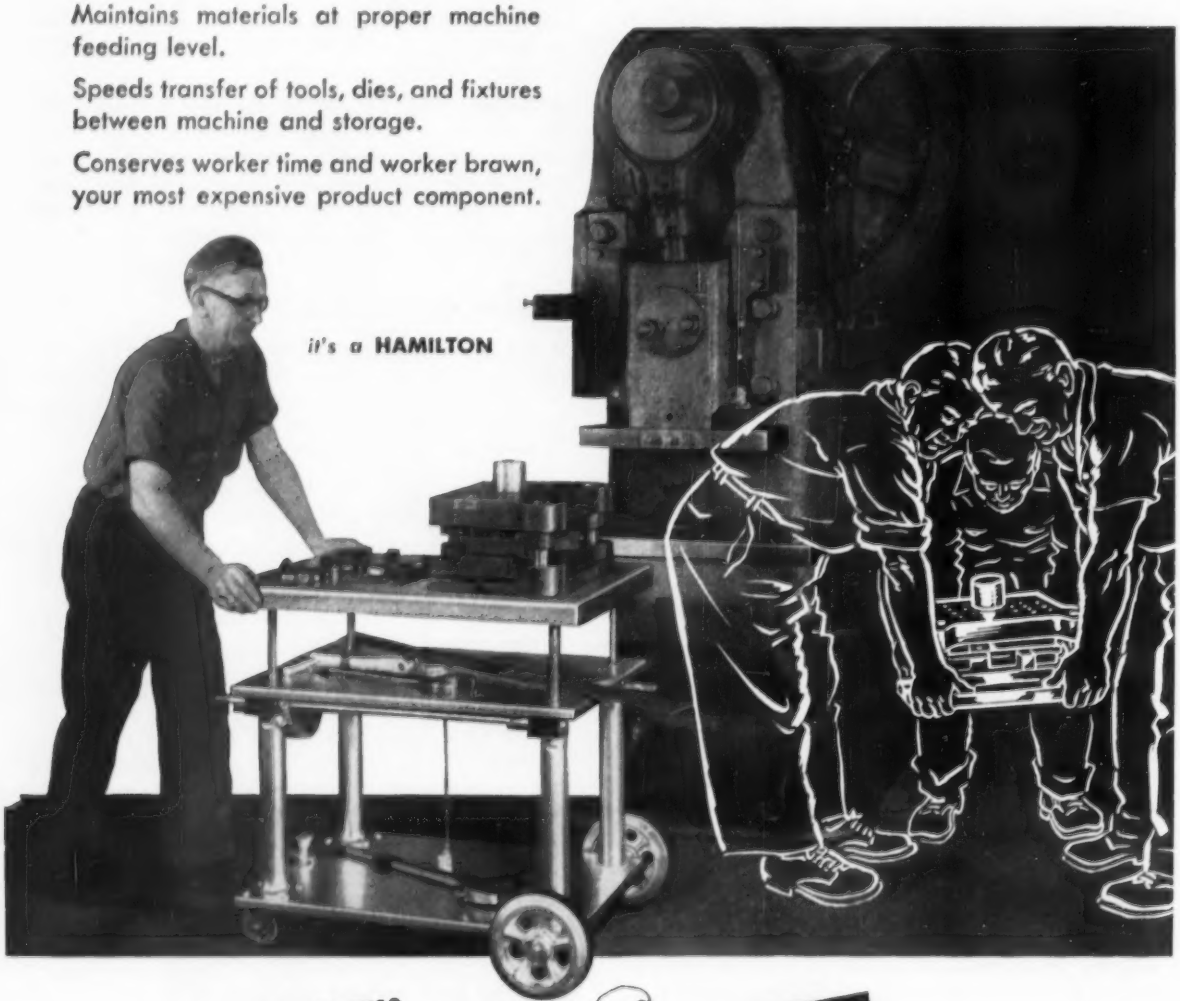

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Machine Tools . . .

Orders still at $1-billion-a-year level . . .

New orders for machine tools in February totaled around $90 million, according to early estimates.

This represents a considerable drop from the January figure of $118 million and is far below the bookings of $158 million in December.

February nevertheless far surpassed any month in the January-September period of 1955. Its sales were at an annual rate of more than $1 billion.

The month's new business was far in excess of the industry's shipments.

While demand in the months ahead may not be at the spectacular level that prevailed from October through January, it is expected to be very heavy.

At least the volume of inquiries is indicative of such a course.

Deliveries still are lengthening, especially on elephant tools and special machines such as transfer units.

As costs mount and builders quote on machines to be completed a year or more hence, escalator clauses once again are being inserted in contracts by at least a few companies.

Press builders are more loaded with work than any other machine tool group. Their backlog is creeping up close to two-years' production at the current operating rate.

Trigger program of $200 million ready . . .

The government's so-called "trigger" program for machine tools, which provides for pool orders that would become active instantly in an emergency, has been progressing famously.

Contracts, in fact, may be on the way from Washington to machine tool builders by the time this page appears in print.

The program calls for allocations to builders of upward of $200 million of pool orders.

General Services Administration is the agency that places these contracts. Before it could carry through, it had to have in hand enough money earmarked for the trigger program to guarantee the financial obligations of the government to builders.

The amount of money needed is believed to add up to about $22 million. It is sufficient to provide an advance of 30% in cash to builders who, at the time the program is activated, are unable to secure financing through their normal banking channels.

It also is enough to cover any losses to GSA in case pool-order machines are not sold by builders and have to be turned over to GSA.

Funds to cover trigger-program's financing come from Defense Production Act's Borrowing Authority, bear approval of Office of Defense Mobilization.

German orders total $470 million . . .

The machine tool industries in all the countries of the western world are flourishing.

All of them have big order books, deliveries are lengthening and current sales are large.

Take the West German industry. The average builder has 10-12 months' backlog. The value of business placed during 1955 is put at more than $470 million.

Production of German machine tools amounted to some $315 million last year. The dollar volume has been at least $230 million a year each year since 1952.

In figuring today's operations in the German industry, one should keep in mind that prices rose at least 5-10% the past year.

Exports have consistently been half or more of total business, with three-fourths of exports going to other European nations.

For detailed story about the German machine tool industry, turn to page 140.

British tool output at peak in '56 . . .

Output of the British machine tool industry moved steadily upward from 1949 to 1955, with the total last year adding up to $207 million.

Even so, production did not keep pace with new orders which ran to $264.6 million in 1955.

The actual peak period for sales was in the second quarter of last year. Dollar volume was 21% greater in 1955 than in 1954.

Backlogs of British builders are reported to be around 16 months. Increased assemblies the latter part of 1955 kept deliveries from getting further extended.

For the big heavy machines, orders on hand are enough for up to three years of work at full capacity.

British machine tool production will be larger this year than last by a comfortable margin. The industry is now employing 44,000 workers.

Much of Britain's machine tool prosperity has come from domestic users. Not more than 20-25% of total orders have been from overseas.

Long deliveries, in fact, have hurt severely British builders' chances to get export business.

Latest month's figures show that British industry booked $24 million of new business, of which $5.8 million was for foreign customers. Over-all sales for the same month a year ago were $29 million. Sales continue to outrun production.

FROM ASSEMBLING ELECTRIC TYPEWRITERS TO ELECTRONIC "BRAINS"...

Pictured above is the IBM electric typewriter assembly line at Poughkeepsie . . . and at left, a line of "650's," the medium-sized data processing machines manufactured at IBM's Endicott, N. Y. plant. These are just two of six plants operated by IBM in the United States. Products include electronic data processing machines, electronic and electric accounting machines, time recording devices and time control systems.

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of your advertising in American Machinist at work with IBM . . .

where 83.4% of purchase dollars go for the machinery, materials, parts, and supplies required by PRODUCTION.

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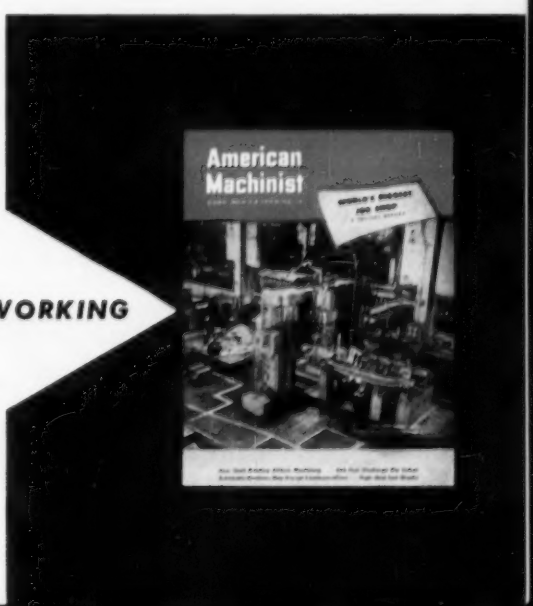

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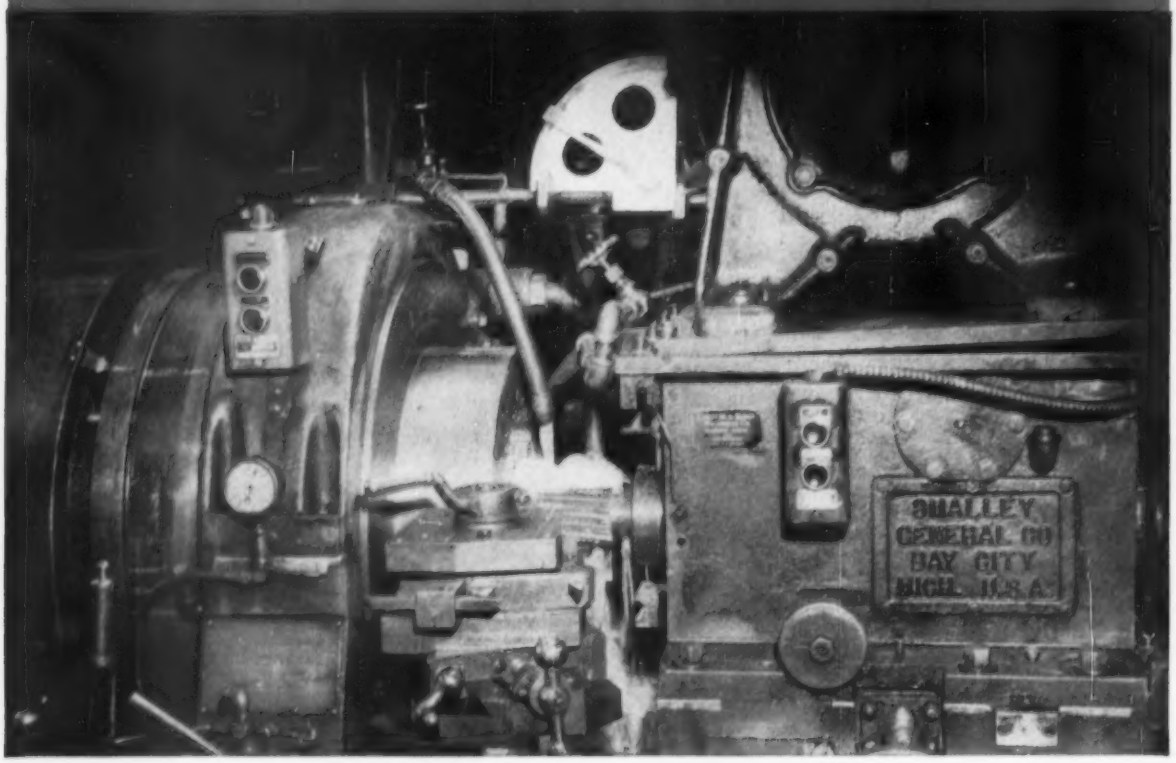
. . . BOUGHT BY THE MEN WHO BUY FOR METALWORKING

BUSINESS PAPER LEADERSHIP ABP

"TEXACO SOLUBLE OIL HAS SAVED US THOUSANDS OF DOLLARS"—says Pennsylvania company

(Name on Request)



THE JOB is milling a step thread. The coolant is a 1:20 emulsion of *Texaco Soluble Oil C*. Tool performance and finish are excellent, and there is *no rust*.

This ability of *Texaco Soluble Oil C* to prevent rust is particularly important here. At one time this company was forced to keep thousands of dollars worth of finished parts on open pallets for four and a half months in severe humidity. But, they report, "We can thank *Texaco Soluble Oil* for the fact that *we had no single case of rusting or indication of rust on the parts.*"

Whatever your metal working goal—rust prevention, increased tool life, better finish, greater production—there is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you achieve it. For hydraulic mechanisms, use *Texaco Regal Oil R&O*. It keeps systems free from sludge, rust and foam, assures smooth, uninterrupted operation.

A Texaco Lubrication Engineer will gladly help you do *all* your machining better, faster and at lower cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

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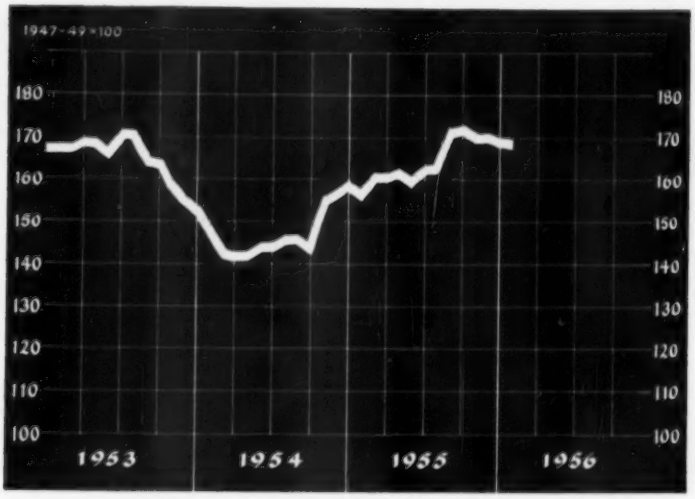
Gaging Metalworking . . .



168

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	FEB Estimated	JAN Preliminary	DEC Revised	JAN Year Ago
Total index	**168**	**169**	**170**	**156**
Machinery	142	143	120	
Electrical Machinery	196	198	192	
Autos	161	176	143	
Other Transportation	288	275	286	
Other Metalworking	143	143	129	

Forecast: sunny weather . . .

There still is little to becloud the metalworking outlook for the first half of the year.

First quarter output has been very close to the record-breaking peak of the fourth quarter of '55.

There is no good reason to believe that it will sag appreciably, if at all, during the second quarter.

Orders booked in all segments of the capital goods industry, with the exception of farm machinery, have been large since the first of the year.

Production of industrial and electrical machinery of all kinds should feel the stimulus of this demand.

New peak in industrial supplies . . .

The strength in capital goods is matched by the powerful sales of industrial equipment and supplies, as reported by the American Supply & Machinery Manufacturers' Association.

They are now at a new peacetime high. The association's index, in fact, is almost double the order rate for the base month of July, 1948.

Almost anywhere in the capital goods field that you look, the story is the same. Business is pushing up toward new heights. The industrial heating equipment industry, for one, is off to a fast start in 1956, with bookings double those of a year ago.

Resistance welding manufacturers report the highest monthly figure for new business in their history.

Machine tool builders are continuing to get orders at an annual rate of $1 billion or better.

In almost all the production-equipment industries, sales are outstripping shipments by a wide margin.

Steel jobbers unable to build stocks . . .

The steel people are thinking in terms of a superb first half, a little letdown in the third quarter, and a very strong fourth quarter.

Steel warehouses say it is impossible to build up stocks of sheets, plates and most rolled shapes.

Outlook is for a continued tight supply, especially in sheets and plates, for some months. Stainless and alloy steels, however, are easier.

Some inventory-building of steel unquestionably is in progress. How much of it stems from anticipation of higher steel prices and how much of it is a hedge against a possible strike, no one knows. But both factors are present.

While automobile production is not what it was a year ago, it is large by comparison with any other standard than 1955's.

Building construction looks better than it did. This year won't come up to last year's volume, but it will be big.

Tractor business off . . .

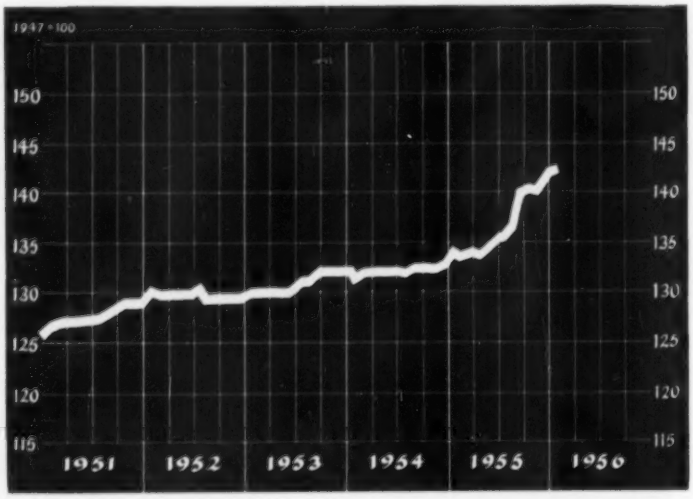
Tractor builders have followed the lead of the automobile people in cutting back their production schedules. Farmers have less income and are buying implements in smaller volume. Hence manufacturers of farm equipment have curtailed operations recently. A few farm-implement plants actually have been shut down.

Household appliance makers are preparing for a big selling season. One important company, typical of others, reports sales up sharply from last year with its factories running two full shifts.

Gaging Business . . .

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	FEB Estimated	JAN Preliminary	DEC Revised	JAN Year Ago
Total Index	**142.3**	**142.1**	**140.9**	**133.9**
Metalworking Machinery		158.6	158.1	143.9
Other Machinery exc. Electrical		147.8	147.4	137.6
Electrical Machinery		137.0	136.8	132.0
Fabricated Metal Products		136.0	135.9	130.7



Rosy glow from Washington . . .

"Much better business in '56 than expected" is the tone of two important government reports just released. They both maintain that business will be booming throughout the year.

The first report is the University of Michigan's "Survey of Consumer Finances," undertaken at the University's Research Center for the Federal Reserve Board. The man in the street is highly optimistic about business conditions, says the FRB survey.

And, because he's the man who buys the nation's goods and services, it stands to reason the outlook for consumer buying will be good all year.

Just as many people plan to buy new and used cars, appliances, furniture, and new and used houses as there were in 1955.

About 40% of them expect to make more money a year from now on: only 10% expect to make less.

A large proportion expect good business conditions: only 9% look for bad business conditions. That's the smallest group of pessimists since the FRB survey was started a decade ago.

Second optimistic government report is the Commerce Dept's "Survey of Business Plans for Investment in New Plant and Equipment," which indicates a 22% increase in capital goods spending for the year ahead. For manufacturing, the survey shows a 32% gain. It is interesting to note that this survey was carried out before President Eisenhower indicated he will run again.

The Commerce Dept survey confirms McGraw-Hill's survey, taken last October, when the planned increase for all business was for 13%, and for manufacturing industries 30%. Details on page 142.

Auto cutbacks increase jobless . . .

Decline in auto industry employment was the chief factor in a January-to-February drop in employment of 300,000 workers to 62.6 million. A good deal of the drop can be attributed to the auto cutback's effect on supplier industries.

Unemployment went up slightly, but the figure held close to 2.9 million for January and February. Reason the increase in unemployed didn't equal the drop in employment was that people with seasonal jobs dropped completely out of the labor force.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	150.7	150.8	139.5
Steel ingot operation (thousands of tons)	2,433	2,462	2,273
Electric power output (million Kilowatt hours)	11,133	11,199	9,726
Production of automobiles and trucks	166,239	167,422	204,285
Engineering construction awards (Eng. News-Record—millions)	$648.9	$413.8	$374.8

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of Industrial production (1947-1949 = 100)*	144	144	133
Index of durable manufactures production (1947-1949 = 100)*	159	160	147
Durable goods manufacturers' sales, millions*	13,634	13,688	11,850
Machinery manufacturers' new orders, millions*	3,738	3,648	3,075
Durable goods manufacturers' new orders, millions	14,710	15,605	12,142
Machinery manufacturers' new orders, millions*	3,827	4,118	2,936

* Seasonally adjusted

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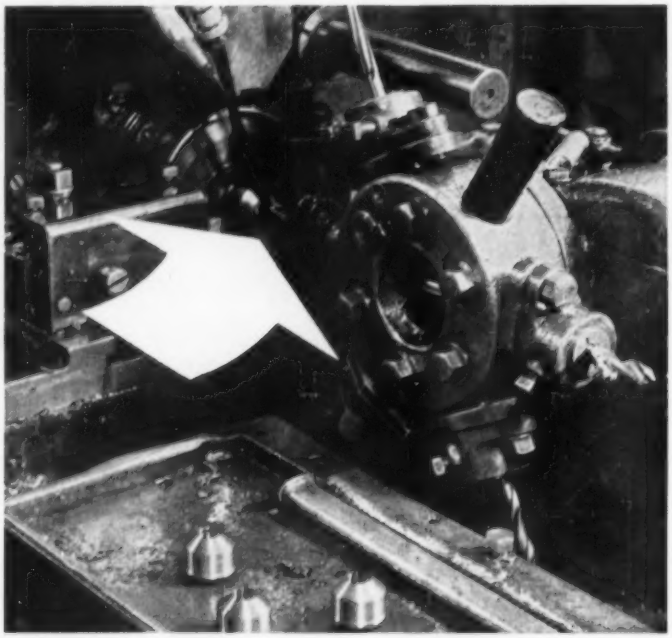
CUT YOUR COSTS 4 WAYS



It's right at the cutting edge where machining costs are cut. And that is where Armco Stainless Steel bars can help you 4 ways.

Less "down" time

Armco Stainless Steel bars give you uniform machinability from end to end and bar to bar. You have no unnecessary, costly delays to adjust machine settings or tooling in order to maintain tolerances on size or finish. Jobs can be completed in a hurry, at less cost per piece.

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Armco Stainless bars offer you a wide range of sizes in standard shapes and special shapes. These special stainless bar shapes give you the opportunity to reduce machining time and possibly eliminate entire operations. You save time and money, turn less bar stock into chips.

Armco Stainless can fit the job

Armco, one of the largest producers of stainless steel in the world, offers you more than 30 standard grades of stainless bars. This way you can select a grade that exactly meets specified strength and corrosion resistance requirements. And to save you money on machining, Armco offers you free-machining varieties in most of the commonly used stainless steels. Machining speeds range up to 85% of that for Bessemer screw stock.

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For over 20 years Armco men with shop experience have been helping shops get the most out of their equipment on stainless machining jobs. And they have run thousands of machinability tests. They know stainless steel and they know how to help cut costs and step up production. This valuable experience is yours for the asking.

* * *

If you are making corrosion resistant parts or quoting on them, consider Armco Stainless Steel bars. Let their 4 cost-cutting advantages work for *you*.

For complete information on sizes, shapes and grades of Armco Stainless Steel and for machining data, just fill out and mail the coupon today.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

1966 . . .

The average employee of General Electric may be earning $8,000 a year by 1966, compared with around $5,600 today.

This startling observation comes from GE's president Ralph Cordiner. He does not base his prediction upon a belief that average incomes will go up some 42% in the next ten years, although they are almost sure to rise appreciably. He leans to the opinion instead that there will be a higher ratio of skilled to unskilled jobs a decade from now.

The larger percentage of skilled workers will be a direct outgrowth of the strides made by automation. The more skilled workers in relation to the total work force, the higher the pay.

And that brings us to a study of the effects of automation on the labor force, made by the United States Department of Labor.

"From developments of the last few years," the study states, "it appears that a large number of semiskilled workers will be displaced as a result of the advances of automation."

More than that, however, is the anticipated increase in the proportion of skilled workers. To illustrate the point:

In the automated factory . . .

there will be more engineers, more electronic technicians and more machinery repairmen. At the same time, there will be fewer machine operators and fewer laborers.

The servicing of automatic equipment, the study states, will require considerably more machinery repairmen and electronic technicians.

Not to be overlooked as an important factor is the industry that builds automatic machinery. It will need more engineers, more tool and die makers, more machinists and more electronic technicians.

All of these considerations add up to powerful support of Mr Cordiner's thesis: that the average income of workers in General Electric (and in all other companies) is likely to rise sharply the next ten years.

We will be trending . . .

in the direction of becoming a nation of skilled rather than unskilled peoples, thanks to automation and its implications.

This means, in turn, that the average buying power of the American worker will be boosted spectacularly. He will have more money to spend than ever before on the things that make for comfortable and pleasant living, including automatic devices in the home that are the counterpart of automation in the factory.

This is the sort of upgrading in skills and in incomes that has produced through the years a standard of living in America that has been the envy of other countries.

Before these highly desirable objectives can be attained, however, action must be taken to see that an adequate number of people acquire the skills necessary to do the jobs that loom ahead.

A much larger skilled labor force . . .

can be created only if certain things are done. For one, workers themselves will have to put forth special efforts to learn new skills.

Manufacturers will have to make it possible for their men to acquire skill while they work, as well as to set up and operate apprentice and other training programs. At the State and local levels, government educational systems should have a big part in the program too.

If Mr Cordiner's prediction of an $8,000-a-year income is to come true, and if the Department of Labor's study is accurate, it is time that we get going in the direction of creating today the skills that will be needed tomorrow.

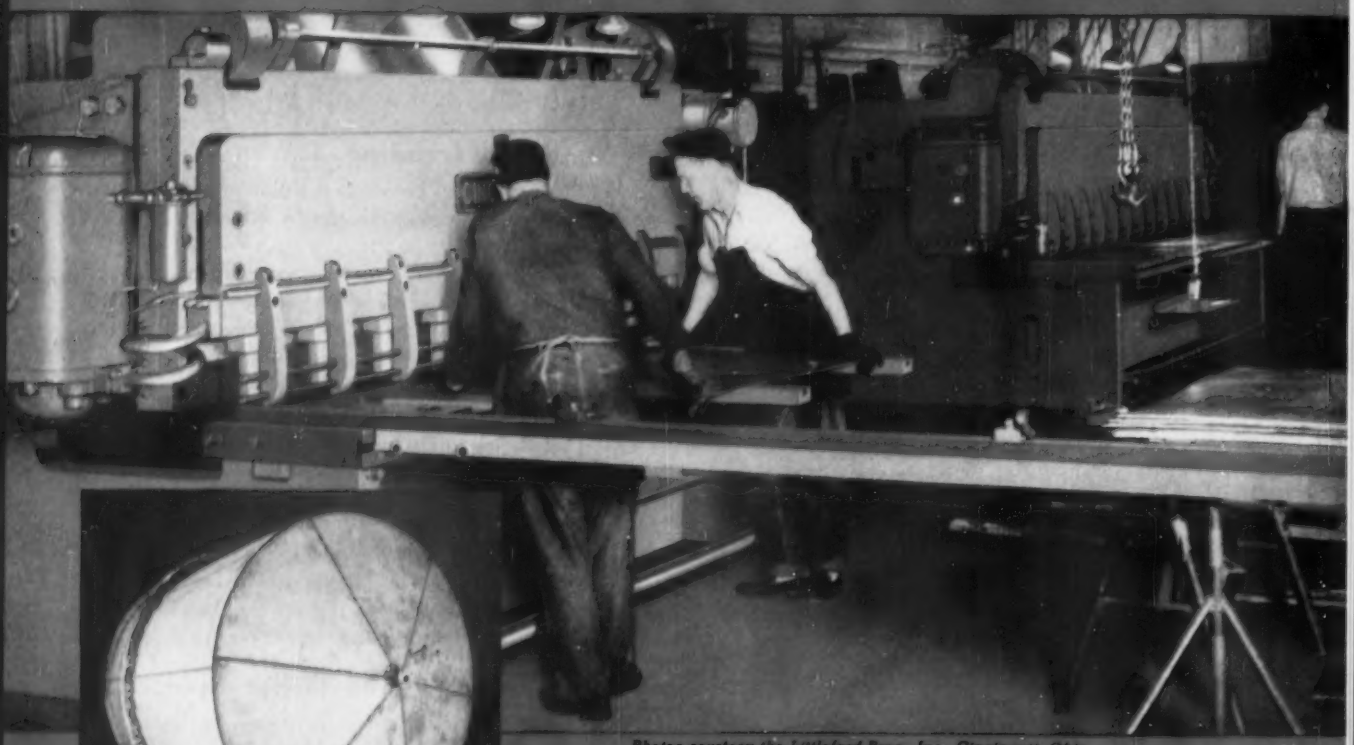
Burnham Finney

EDITOR

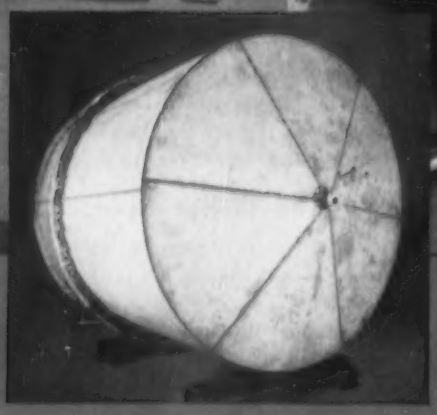
They handle the job faster with

CINCINNATI Shears

at LITTLEFORDS...



Photos courtesy the Littleford Bros., Inc., Cincinnati, Ohio.



Shearing stainless steel for tanks in the Littleford Shops.

"Faster handling—with a high degree of accuracy", say Littleford Bros.

Simple, rapid and positive gauging, with the accurate shearing performance of these Cincinnati Shears—gives a clean cut, economical production, with long knife life and low maintenance.

Write for Shear Catalog S-7

THE CINCINNATI SHAPER CO.

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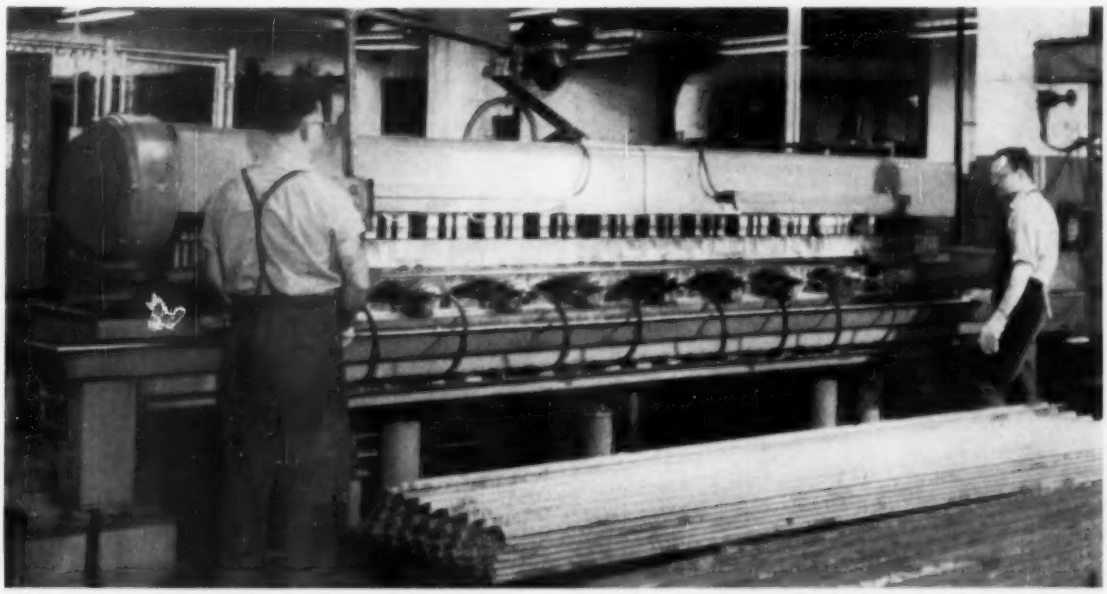


COMPLEX HOLE PATTERNS ARE DRILLED automatically in flat, angular and other structural shapes with this modified Moline rail-type machine. A hydraulic feed raises the table and work to the drills while a hydraulically actuated fixture on the table clamps the work and indexes laterally and longitudinally to any combination of four preselected positions. An unloading position is subsequently reached where parts are automatically unclamped, unloaded and new work is installed

Hydraulic fixture locates and feeds parts in multiple drilling

Over 100 different hole patterns are required in various steel components of telephone switchboard frames. To complicate matters, job-lot quantities of 25 to 1000 pieces are run with anywhere from 10 to 272 holes in a particular part. Here's an efficient and automatic method of handling this job

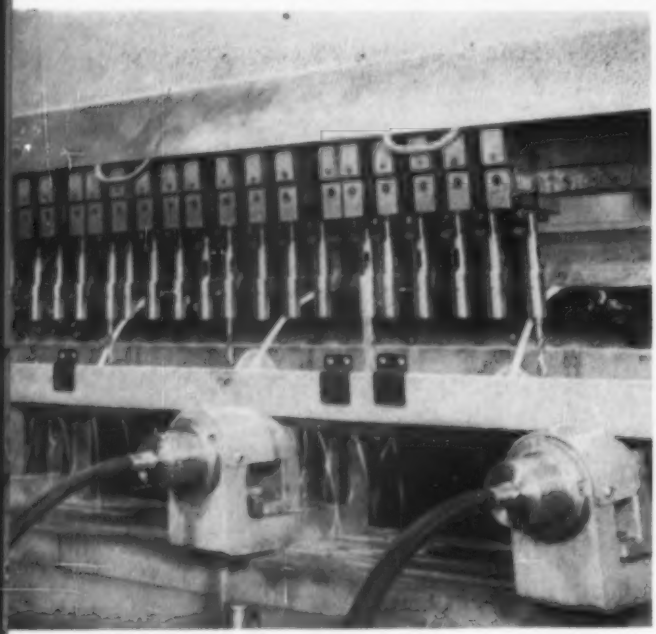
S SNOREK, machine-tool design engineer
WESTERN ELECTRIC CO, INC.
Chicago, Illinois

Drilling holes in structural-steel components for telephone switchboard frameworks is a tailor-made operation at Western Electric's Hawthorne Works. Quantities run from 25 to 1000 pieces, with anywhere from 10 to 272 holes in a particular part, and sizes range from 9 to 169 in. long. The job is handled quickly and easily with a modified Moline rail-type drilling machine equipped with a hydraulic table feed. An electrically controlled hydraulic fixture mounted on the table automatically indexes the work laterally and longitudinally into any combination of more than 100 different hole patterns to drill the parts completely in one setup.

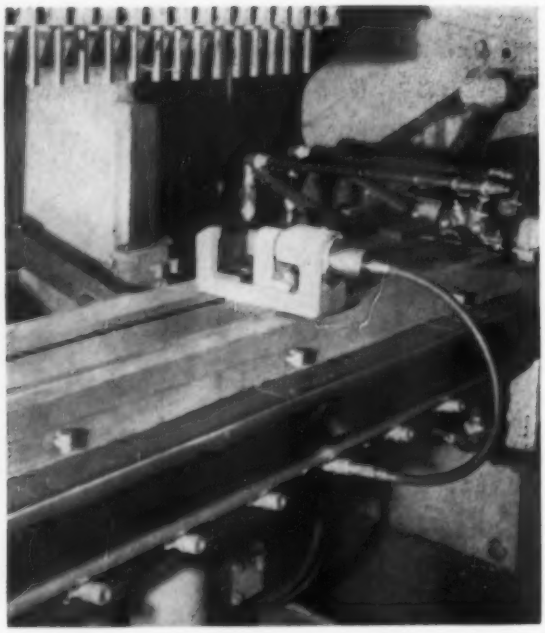
The machine can drill up to 70 holes in a single row at one time and has a minimum spindle center-to-center dimension of 1 in. and a maximum end-spindle to end-spindle dimension of

American Machinist

Hydraulic fixture locates and feeds parts in multiple drilling . . .



MINIMUM CENTER-TO-CENTER DISTANCE of drill spindles is 1 in., maximum span between end spindles is 14½ ft. Bushing plates are rectangular bars of various lengths, and 66 of them contain 1459 bushings to accommodate various hole spacings and patterns. A channel-shaped bushing-plate holder with closed ends also serves as a reservoir for coolant—extends the length of the fixture and is guided in ways fastened to the fixture base. A large sheet-metal trough fastened to the machine table returns coolant to a reservoir from which it is pumped back to the bushing-plate holder



HYDRAULIC WORK CLAMPS are quickly and easily relocated to suit various part lengths through "Snap-tite" couplers that connect to any of 22 outlets spaced uniformly along a manifold. The work fixture consists of a 17¾-ft-long base, a drill-bushing plate and two sliding platens. Both platens index laterally, but only the upper platen (to which the clamps are bolted) indexes longitudinally

14½ ft. Spindles, driven by a horizontal spiral gear that extends across the front of the machine, are easily aligned with bushing-plate hole locations to suit various hole patterns within these capacities. Drilling is accomplished by feeding the table and work vertically toward the drills at a variable speed to suit drill diameters. Rapid traverse is employed to and from the drills.

HOLE PATTERNS ARE COMPLEX

In many parts, holes extend along a single lengthwise row and are drilled in one operation, or lift. Some however, require more than one lift because of such conditions as: (1) more holes in a row than drill spindles in the machine, (2) hole spacings smaller than minimum spindle spacing, (3) part contains two lengthwise rows of holes. Four drilling patterns are therefore provided with one, two, or four lifts:

A. *One lift*—for parts with a single row of less than 70 holes and with center spacing of 1 in. or larger.

B. *Two lifts with a lengthwise index between lifts*—for parts with a single row of less than 70 holes with hole center less than 1 in. Also for parts with a single row of more than 70 holes. Each lift drills alternate holes.

C. *Two lifts with a crosswise index between lifts*—for two lengthwise rows of less than 70 holes each having center distances of 1 in. or larger and with identical hole patterns in each row. Each lift drills a complete row of holes.

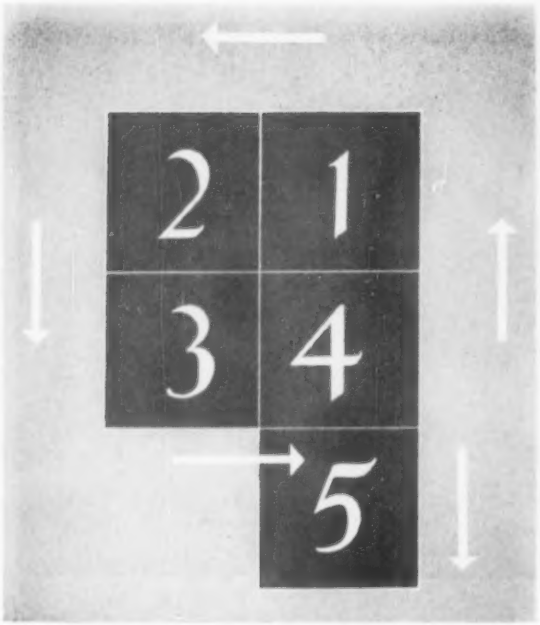
D. *Four lifts with both lengthwise and crosswise indexes*—for two lengthwise rows of less than 70 holes each, with hole centers less than 1 in., and with identical hole patterns in each row. Also for parts with two rows of *more* than 70 holes, with identical hole patterns in each row.

The required pattern is easily set by a selector switch which changes the control circuit to energize only those components needed for the pattern selected.

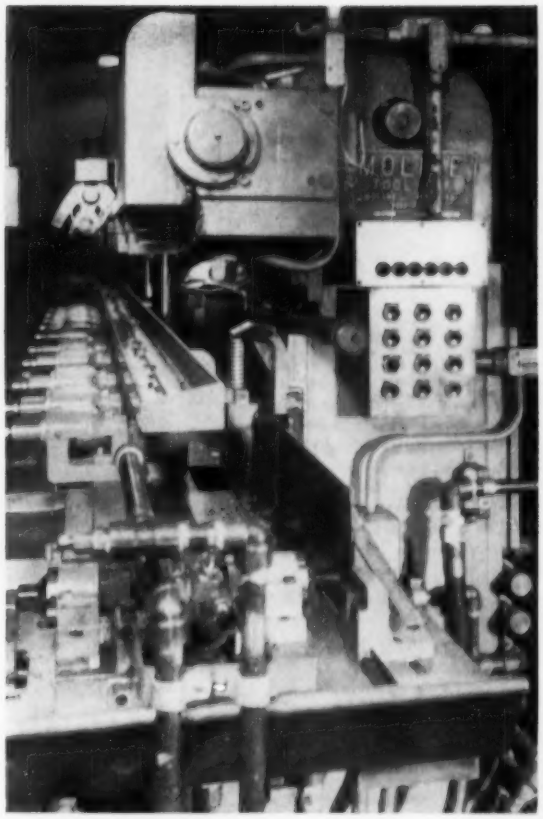
CIRCUITS INTERCONNECTED

Hydraulic clamping and indexing cylinders that operate the fixture are controlled by solenoid-actuated valves, relays, pressure switches and a timer. This circuit is interconnected with the machine control circuit so drilling cycles are initiated when the fixture reaches proper location after indexing, also to initiate fixture index after a drilling cycle. In this way, continuous automatic operation is provided.

Two sliding platens are mounted on the fixture base to index cross-wise as a unit—an upper platen that indexes both longitudinally and laterally and a lower platen that moves only in the lateral direction. Two linkages, one at each end of the fixture,



MICROMETER STOPS INSURE ACCURACY of indexing, are adjustable to suit a wide variety of hole locations. Complete index pattern includes four drilling positions, the fifth being for loading and unloading. The fixture is indexed from station five to any combination of drilling stations 1, 2, 3, or 4, according to the requirements of a particular part, then returned to station five when drilling is complete



prevent the lower platen from twisting out of position while indexing. Each linkage has a horizontal arm fastened to the platen and a vertical arm keyed to a torque shaft mounted in the upper portion of the machine. Adjacent to each horizontal arm is a hydraulic cylinder for indexing both platens laterally. A third cylinder attached to the right-hand end of the lower platen handles longitudinal indexing of the upper platen.

STOPS, CLAMPS AND BUSHINGS

Adjustable micrometer stops control indexing in both directions. One at the rear is permanently fixed on the fixture base to limit backward movement of the platens. Another at the front controls location of the fixture in the forward position and can be completely retracted into the base to permit indexing the platen to the extreme forward edge of the base for loading and unloading. This stop is actuated by a hydraulic cylinder under the machine table and is controlled by the the circuit that actuates the complete drilling cycle.

Longitudinal indexing of the upper platen to the left is controlled by a similar stop while the stop controlling indexing to the right is fixed. No adjustment is needed in this direction because dimensions are controlled by positioning the drill spindle.

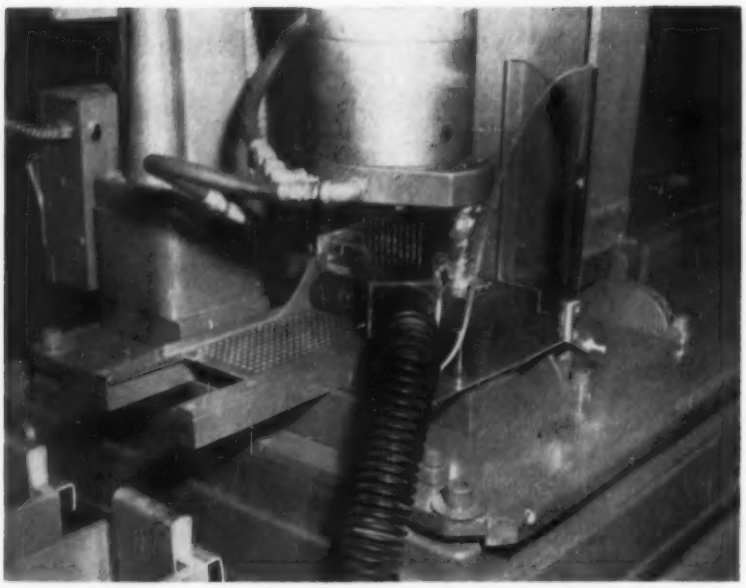
Clamps are small, specially designed hydraulic vises bolted to the upper platen and keyed for alignment in a slot that extends the length of the platen. Oil supply is obtained from a manifold under the machine table to which quick-connecting couplers are attached as needed. This provides flexibility in locating the proper number of clamps needed to hold and support parts of any length or shape on the machine.

The drill-bushing plate holder, a channel-shaped trough with closed ends, is guided in ways and suspended in a double opposed spring mounting positioned high enough to permit indexing the part without interference. Moreover, work and holder are raised as a unit when the part contacts the holder at the start of drilling. Vertical adjustment can be made so drills never leave the bushings.

MANUAL AND AUTOMATIC CONTROLS

Operation of the fixture is handled at an overhanging control panel where one button actuates the clamping units and a second starts the automatic drilling and indexing cycle. An emergency stop button is provided to shut off all motors, feeds, and indexing if difficulties arise during operation.

During setup, both fixture and machine can be controlled manually by buttons on a semi-automatic control panel. Loading and drilling positions, drill feed up and table feed down, as well as motors and pumps, are provided with individual controls to permit separate operation.



MULTIPLE DRILLHEAD perforates row of ten holes in plastic resistor board for a dc amplifier. Two hardened-and-ground die posts guide head and bushing plate, which also clamps work. Clear-plastic enclosure directs air stream so chips are blown into vacuum duct (foreground) which leads to chip bin. Complete unit, with baseplate, can be demounted from machine

This automatic drill was built with standard

It meets four tough requirements set down as targets for a tailor-made machine:

1 . . Completely automatic, except for loading, unloading, setup

2 . . Built up from commercial components, with electrical control and air power, which eliminate expensive mechanical motion and timing devices

3 . . Quickly converts for other uses

Simple feeding—minimum critical machining required

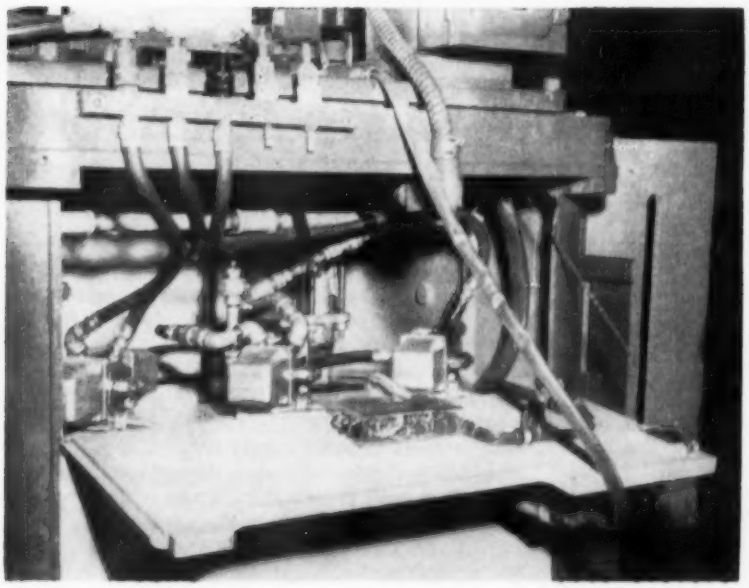
WILLIAM BARBOUR, tool engineer,
LINK AVIATION, INC. BINGHAMTON, N. Y.

The reason for this unusual drilling machine was a good-size order, by Link standards, for resistor boards to go into a dc amplifier. They are made of tough, abrasive plastic, and require 250 holes each, in 25 rows of ten. Work was started with a hardened drill templet, doing two boards at a time, but production at a single-spindle drillpress was only 32 boards per 8-hr day.

If a special machine could be built, it would have to be adaptable for other work as well. Link engineers started by laying down the requirements listed at left. The first purchase was a Beckett Harcum drillpress equipped with a quick-reverse motor, which would allow tapping operations when the shop was caught up on resistor boards.

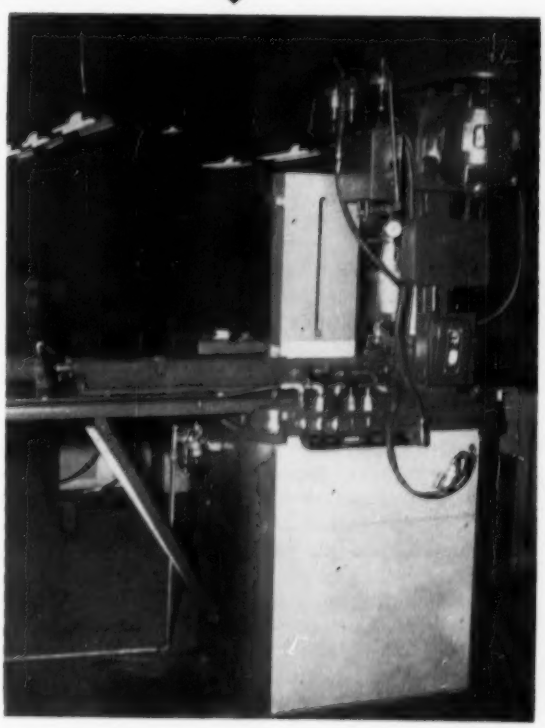
Next, a Zagar multiple-head drill was installed, and the drill spindles were set on 0.31125-in. centers. They were also offset 0.5 in., which would allow installing another set of spindles on different center distances, reversing the head 180°, and using it on some other job. Also, the eccentrics on the head were lightened and critically balanced to permit higher speeds necessary for drilling the plastic material.

The fixture built for drilling the boards has hardened die posts to guide the head, insuring accuracy to ±0.002 in. A bushing plate rides up and down as the machine cycles, guiding the drills and also clamping the work after it indexes. This plate is powered by an air cylinder; it also serves as a mani-



THREE ELECTRO-PNEUMATIC VALVES control air cylinders, which feed drillhead, operate bushing plate, feed in new resistor board, and hitch board along after each row of holes is drilled. Machine enclosure is normally locked to prevent tampering. Other controls include precision limit switches

AUTOMATIC DRILL IS BUILT UP from Beckett Harcum drillpress with Zagar multiple drillhead. Feed hopper is on table, attached to baseplate. Identical hopper at right receives drilled resistor boards. Unit does work of six conventional drills, yet can be changed over for another precision-drilling or drilling-and-tapping job in 30 min



components

fold to confine air that cools the drills and blows out chips.

Another air cylinder hitches the board 5/16 in. along after each row of holes is drilled, working through a spring-loaded finger. Tapered pilot pins engage the holes to locate the board exactly while the next row is drilled.

Feeding is also automatic, from the bottom of a specially designed magazine that holds a stack of boards. The same kind of magazine receives drilled boards at the end of the drill table. The only manual work required, aside from setup, is locating a new magazine and taking away a filled receiver. The feeder mechanism, an air cylinder, operates when a precision switch—normally held open by a board in drilling position—closes as the board is ejected to the receiving magazine. Then a new board is indexed into position.

Removing the plastic safety shield makes the machine shut down.

Results have been outstanding. The machine does the work of six men at ordinary drillpresses, reduces drill breakage and increases their life, and it can be converted in 30 min to another job. This operation is fairly simple:

First, die posts and clamp rods are unlocked and removed, then air connections are broken. The electrical connection is broken, and a jumper plug is installed to revert the machine to its original control circuit. Screws and dowels are removed, and the entire table assembly is taken off; then the Zagar head is removed. Now the drill is ready for setup for more conventional operations.

Link doesn't claim they've made a new machine. Rather, they have applied easily obtained pneumatic and electrical components to a versatile drillpress, obtaining high speed and low cost on a production item.

How to understand chip formation

ANTONI NIEDZWIEDZKI, DETROIT, MICHIGAN

The most important machining problems are rather simple and logical; it is even possible to apply mathematics to compute *in advance* what will happen in any given machining operation.

Like several physical functions, in particular those of friction, machining functions can be presented as straight lines traced in a logarithmic network of coordinates. Exceptions to this rule mark the influence of secondary factors and, in particular, changes in heat-dissipation rate. Even very abrasive materials affect tool-wear rate very little at normal cutting speeds, and flank wear is proportional to tool travel. Thus, any deviation from the usual pattern of the machining process results in a discord between the machining formula and reality.

Modern industrial methods and achievements take care of high productivity by an increase of specific microwelding temperature, by a reduction of cutting temperature, by more and more smooth cutting edges, and by improved lubrication. At this point, antiwelding agents are introduced, alternately by material cut ("free-cutting" steels and alloys), by the tool material (with "internal lubricants" incorporated), or by the cutting fluid. Here also belong improvements in cutting-fluid circulation and penetration (better piping, coolant aeration, use of "wetting agents," "High-Jet" method, artificial cooling of cutting oils, carbon dioxide, mist cooling, etc).

Reproduction of machinability characteristics for a given material might be assured by improved metallurgical processing and methods (castings) and/or an adequate heat treatment (isothermal annealing of steel forgings). It might be checked by microstructure examination or by an appropriate cutting test.

Under the tool life "T", in minutes (Fig 1), we will recognize the cutting time necessary to produce a given amount of tool wear. This "tool-life criterion" should be the average width of "flank wear" (for example, h = 0.010 in.) for "edge-wearing" (turning) tools, or the average width of "side wear" for "side-wearing" tools (like drills, wearing on a non-cutting tool surface). As the practical knowledge of "how" should coincide with the theoretical knowledge of "why," we discuss them jointly

CHIP FORMATION

Chip removal is accomplished by the cutting tool shearing each chip from the workpiece and curling it against the rake face of the cutting edge. The removed chip remains under a joint influence of two equal, opposite, and parallel forces: "W", exerted by the revolving workpiece, and "T", exerted by the cutting tool.

The force "W" (point "A") is counterbalanced by the chip reaction "C_W", which is composed of the primary chip deformation force "D_1", and the shearing force "S", perpendicular to the machined surface, along which the chip shearing takes place. Each chip element is first of all primarily deformed, sliding along a curved surface (convex to the workpiece and concave to the chip), the chord of which coincides with the direction of the force "D_1". Primary deformation ends when the produced "shearing force", "S", exceeds the shearing resistance (continuous chip), or when it exceeds the critical deformation limit (fragmented chip).

The tool force "T" (point "B"), is counterbalanced by the tool side-chip reaction "C_t", comprising chip-friction force "F" (chip sliding along the rake face) and from secondary chip-deformation force "D_2" (perpendicular to the rake face).

This chip-formation diagram disregards (for the sake of simplicity) the existence of a small supplementary force, parallel to "W", affecting flank wear on the relief face of the tool.

TOOL WEAR

As the rubbing surfaces of the tool edge and the work, or the chip, are never perfectly smooth, their minute peaks and valleys of surface roughness hook onto each other. A collision between two meeting peaks may produce either purely mechanical abrasion (A harder peak cuts off a softer one, acting like the abrasive in a grinding wheel or like a saw tooth) or abrasion minute welding. In the latter case, the colliding peaks form an initial weld which, by a further mutual move, is broken at its weaker peak. Thus, chip formation and tool wear are evidently affected by "microwelding factors," and by the strength of the work and the tool materials, which varies as existing temperatures.

These microwelding factors might be considered:

1. **High (chip) pressure**, applying both rubbing surfaces (tool and workpiece or chip) to each other.
2. **High (cutting) temperature** at the rubbing place (on the cutting edge).
3. **Intimacy of metal-to-metal** contact of both rubbing surfaces (helped by their plasticity).
4. **Long duration of above intimate contact** (inversely proportional to the cutting speed).
5. **Faculty for forming solid solutions** by both rubbing materials or their constituents and a possibly low-melting point of such solutions.
6. **Favorable microstructure:** coarse grains (more readily deformable and thus helpful in a high-contact intimacy), coincidence of fiber lines with rubbing direction (no contact interruption), etc.

and tool wear

Intimate metal-to-metal contact, necessary for microwelding action, might be interrupted by a protective coating made from an isolating film formed by one or a few antiwelding agents. The agent may be included inside the material being cut (free-cutting steels and alloys), may be carried by an internally lubricated tool material, or, usually, by the "chemically active" cutting fluids.

Antiwelding agents may be "direct" (lead, sulfur, or graphite), if they are the direct constituents of the protective coating. They also may be "indirect" (various sulfides, like MnS, PbS, MoS_2, etc.) forming a protective coating by an exchange reaction with the tool or the workpiece. Or, finally, they may be "catalytic" if they act as catalyzers in an exchange reaction between tool or workpiece and coolant or air. The product of such a reaction might be an oxide for example: (FeO), serving as the protective coating. Another form of protective coating may be produced by the fatty particles in cutting or soluble oil.

An antiwelding agent must not form solid solutions with work or tool materials and their constituents. Should the delivery of an antiwelding agent to the rubbing place be impractical, the effect of friction might be reduced (instead of prevented) by coolant or by raising the "specific microwelding temperature" of tool and work materials. This trend has been followed in the gradual development of cemented carbides. The initial grade of 1926 (94% WC + 6% Co) has shown a specific microwelding temperature far too low for steel. A further improvement (since 1932) has been possible, thanks to the addition of other carbides (TiC and TaC), which raises the microwelding temperature but, unfortunately, increases the brittleness and lowers the thermal conductivity.

TOOL MATERIAL IMPORTANT

Grain-size influence is seen in the development of some cast-iron grades of cemented carbides. Thus, the above-mentioned initial grade (94% WC + 6% Co) works well on gray cast iron up to 200 Bhn and is of a grain size similar to other common steel-working grades. Anyhow, harder cast-iron grades (above 200 Bhn) are better machined with a harder carbide grade, which very often has exactly the same composition but a finer grain size. For chilled, very hard, cast irons or for sandy castings and for castings with hard points, it is necessary to combine the influences of both composition and grain size (fine-grained grade 92.5% WC + 1.5% TaC + 6% Co). The influence of grain size might be confirmed for both work and tool materials. Coarse grained microstructure of either usually tears or scuffs the machined surface, which coincides with the builtup-edge formation.

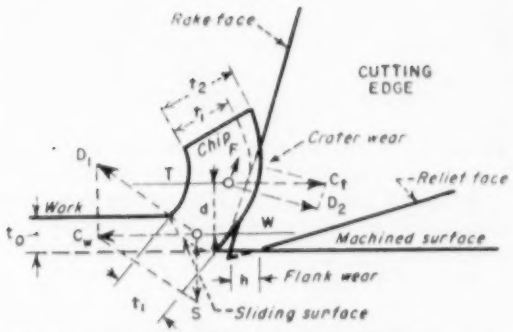


FIG 1.. SIMPLIFIED CHIP-FORMATION DIAGRAM, for structural steel (chip type 2) with cutting action fully engaged and balanced

Also of major importance, is not the quantity alone, but the *location* of the generated heat. Heat centralized directly on the cutting edge (cast irons) stresses the importance of specific thermal conductivity of cemented carbide. Heat, generated in two distant places, for example on the flank ribbon and on the rake crater (steel) reduces the importance of heat dissipation by conductivity in favor of the specific microwelding temperature (compounded carbide grades for machining steel). Tool hardness is not as important as might be generally supposed. Hardness usually coincides with wear resistance, but both are very different and rather uncorrelated properties of a cutting tool.

WORK

Work shape affects not only the rigidity of any machining setup, and the heat dissipation, but also the curling action of the chip and the involved cutting forces. The writer has collected some personal experimental data on this subject. In evaluating his figures (applied to the turning of carbon steel with carbide-tipped tools), the diameter influence seems to be very important and to have a mathematical expression. According to this evaluation, a seven-fold increase in turned diameter can result in doubling the applicable v_{60} value (cutting speed assuring a 60-min tool life). This point merits more attention and investigation; overlooking it might have caused a lot of confusion in establishing turning recommendations.

The biggest influence of the work is certainly its "machinability," which further appears to be influenced by:

1. Amount of critical deformation of chip elements, which probably is correlated to the elongation.
2. Shearing resistance, to be correlated to the tensile strength or Brinell hardness.
3. Co-existing microwelding characteristics of tool and work-materials.

Chip formation usually follows one of these four patterns or types, the last three of which were established years ago by Ernst:

TYPE "0": A short chip, breaking cleanly and with-

out any deformation on its removal from a very brittle material (if no elongation). This type is seldom possible with metals, unless very hard and brittle. It is peculiar to ceramics such as china or glass. The chip fragments and elements are identical here.

TYPE "1": Fragmented, or discontinuous, chip usually removed from the most common gray cast iron grades. Critical chip deformation here is low (elongation is below 1%) and the chip fragments are composed of a few chip elements, sticking weakly together.

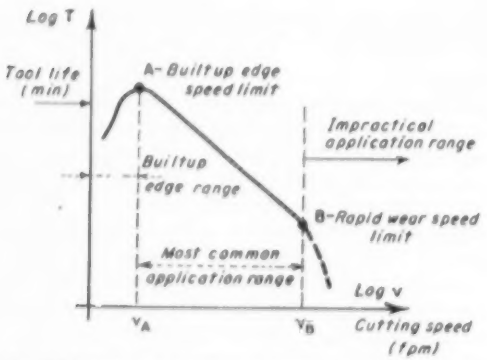


FIG 2.. **TOOL LIFE** as a function of cutting speed

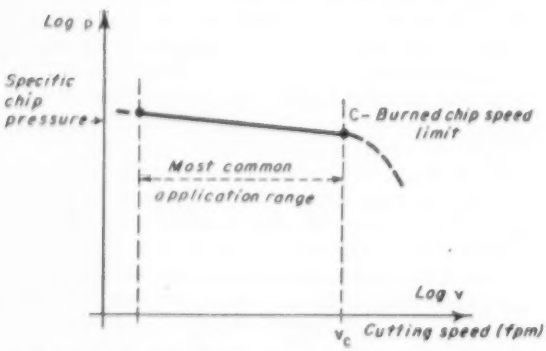


FIG 3.. **SPECIFIC CHIP PRESSURE** as a function of cutting speed

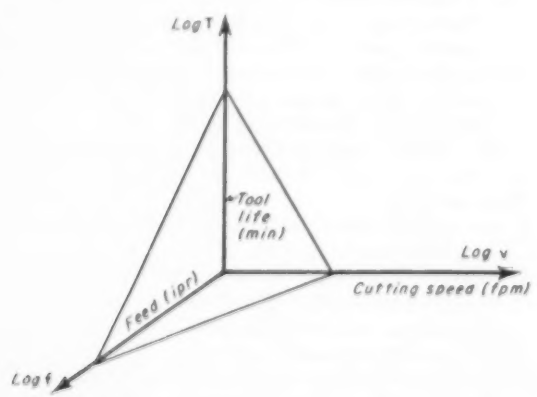


FIG 4.. **SPECIFIC CHIP PRESSURE** as a joint function of speed and feed

TYPE "2": Continuous chip with no marked builtup edge formation, as results from the majority of structural steels having fairly critical chip deformation and an elongation of 10 to 25%, when properly machined. This formation is shown in the chip-formation diagram. Chip fragmentation can be done artificially with an appropriate chipbreaker.

TYPE "3": Continuous chip with a well-marked builtup edge formation as frequently observed when machining austenitic steels (18-8 stainless) with a very high elongation (71%) and excessively high critical-chip-deformation limit.

Thus, the mechanical characteristics of the machined metal very evidently affect both the "D_1" and "S" components of the work-side chip reaction "C_w", acting in point "A", while the tool-side chip reaction "C_t" (point "B") is affected by its friction component "F" (microwelding factors with stress on very intimate contact eased by a high material plasticity) and by secondary chip deformation component "D_2" (controlled by material plasticity, characterized by the elongation figure).

CUTTING TOOLS

As with the work, both the tool shape and the tool material are influential. Inclination of the rake face controls the torque effect of the chip, while its sliding friction is certainly affected by the smoothness of the rake face.

Tool profile and cross-section affect its heat dissipation rate. Composition and microstructure of the tool material affect the microwelding action in the same way as they influence work material, as has been explained in the discussion of tool wear.

WORKING CONDITIONS

Working conditions include cutting speed "v" in fpm, feed per revolution "f" in ipr, depth of cut "d" in inches; also the kind, grade, and distribution of the possibly applied coolant, as well as the selected tool-life criteria. Let us bypass the very important influences of setup rigidity (controlled by the specific machine tool), machined work, applied cutting tool, and possible jig or fixture. Concentrate instead on speed, feed, depth of cut, coolant, and tool-life criteria.

A. CUTTING SPEED controls the contact duration (to which it is inversely proportional) and the cutting temperature, which results from the ratio of generated to dissipated heat quantities. These two influences explain the diagram in which $T = f(v)$ of Fig 2. In very low speeds, below v_A (builtup edge speed limit), tool service ends when edge chipping results from builtup edge formation. In this range, the welds break through the peaks of the work material, which is weaker than the tool material.

A cutting-speed rise above v_A shortens the duration of cut and weakens the welding action which, in the AB range of most common speed applications, is rather weak.

Above v_B, the generated heat quantity exceeds the dissipated heat quantity and produces a rise in cutting temperature, thus increasing the micro-

welding action. Now, the tool material peaks are weaker than those of the work material. The ruptures of the formed welds go through the tool material peaks and result in more and more rapid tool wear. The temperature seems to have, here, a much bigger influence than the contact duration. Tool-wear rate rises and tool life drops very rapidly.

Specific chip pressure p (psi) as a function of cutting speed, $p = f(v)$, is shown. Starting from a very low cutting speed up to v_c (burned-chip speed limit) the specific chip pressure drops very slowly. (For practical purposes it is considered as constant in the most common range of cutting speeds). Furthermore, above v_c the specific chip pressure starts to drop rather rapidly, because of an excessive rise in chip temperature.

The mutual situation of v_B and v_C might be different but, most frequently $v_B > v_C$ and consequently one seldom observes "burned" chips, for example, when rapidly cutting steel using negative-rake tools tipped with a "hard" carbide grade and very fine feeds.

Extending the "most common use range" of cuting speed shows the biggest practical merit. If this range is very narrow, and the "built-up edge" limit v_A and "rapid wear limit" v_B are very close to each other, the material has bad machinability. Then we should attempt to widen this range by the application of harder carbide grades (increase of specific microwelding temperature), coarse feed (decrease of specific chip pressure), or active cutting fluids—if practical.

B. FEED — Chip formation (Fig 1) is controlled by the combination of forces "W" and "T", the arm "d" of which is evidently controlled by the theoretical chip thickness "t_o".

With very fine feeds, the forces "W" and "T" result in very high values of specific chip pressure p (psi) and the cutting edge slides over and cold-works the surface, rather than removing a chip.

This action is similar to cutting fresh bread into very thin slices. The knife tends to slide instead of cutting and we must either harden the bread by drying it, or increase the slicing thickness before cutting is efficient. Similarly, the chip-removal action is highly improved by an increase in feed per revolution.

Specific chip pressure is chiefly determined by feed, while tool life is chiefly affected by speed. The other influences are rather slight and often may be neglected, particularly for cemented carbides.

C. DEPTH OF CUT — This chip-formation diagram, made in the chip-flow plane, does not indicate any depth-of-cut influence. Still, this influence exists and the depth of cut may be considered as a major factor controlling the torque effect of the chip, increasing with the depth of cut. The explanation of this effect might best be seen in the different sliding velocities of various chip particles along the engaged length of the cutting edge. Of great importance here is the slenderness of the chip (*depth-to-feed ratio: $d \div f$*) which, for steel working should be matched with the applied chipbreaker and preferably held between 8 and 16.

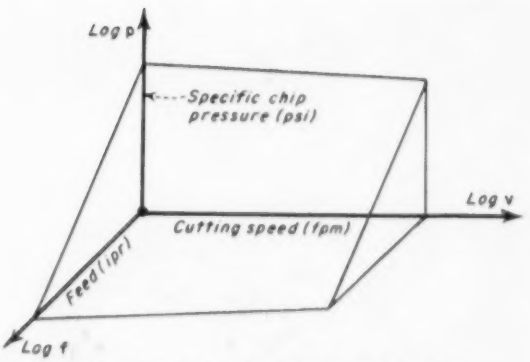


FIG 5 . . **TOOL LIFE** as a joint function of speed and feed

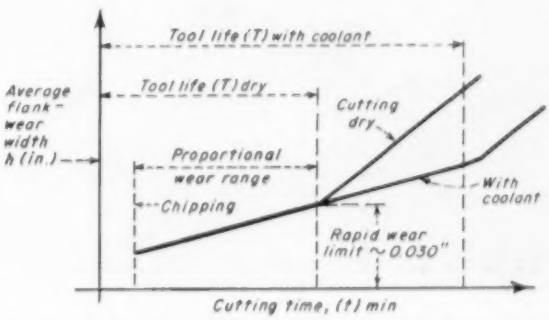


FIG 6 . . **FLANK-WEAR PROGRESS** as a function of cutting time

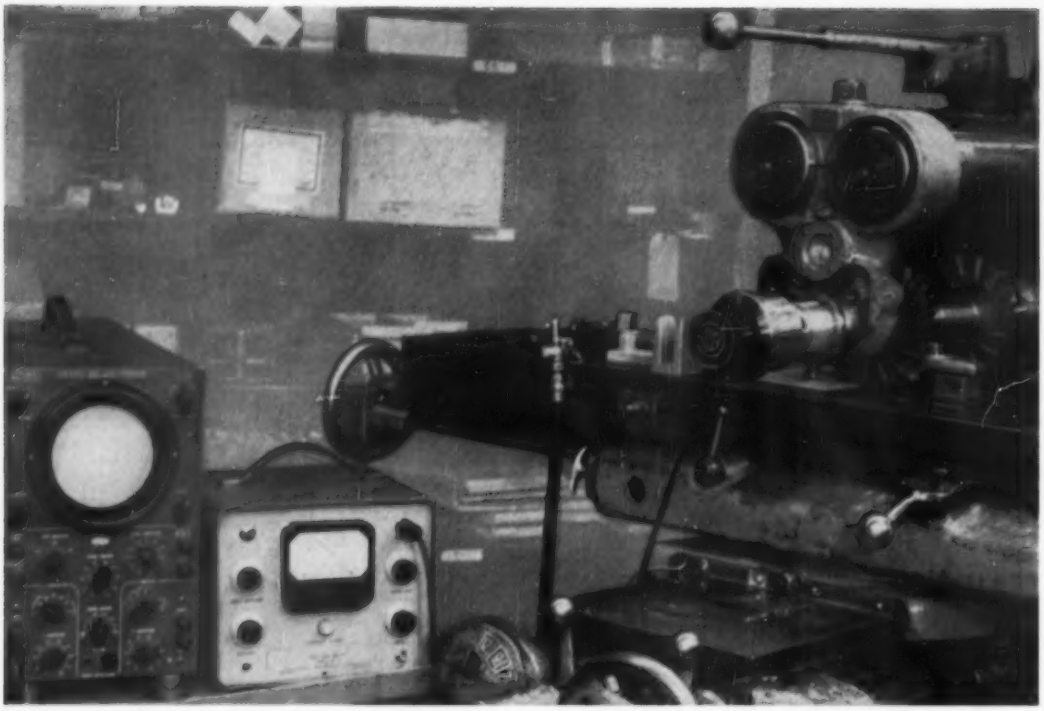
HP consumption is directly proportional to, and tool life is (for carbides) nearly unaffected by, the depth of cut. Its influence consists, to a great extent, in variation of thermal balance of the cutting edge, because of the increased quantity of generated heat and the frequently higher cutting temperature.

D. CUTTING FLUIDS — Lubrication is only possible if the applied cutting fluid has sufficient access to the rubbing point. Otherwise it affects only the heat-dissipation rate, reducing the cutting temperature.

E. TOOL LIFE CRITERIA — As shown, flank-wear rate is a function of time and is affected by the amount of flank wear already reached. Wear on both (relief and rake) faces of the cutting edge changes its heat-exchange ratio, because the cross-section of the heat conductor, out from the cutting edge, keeps decreasing. Because of this opportunity, it is possible to more quickly reach the same point B of "rapid-wear limit" (Fig 2), where the heat-generation rate exceeds the heat-dissipation rate.

After a short period of tool wear by chipping, Fig 6, flank-wear progress is proportional to cutting time. Above a certain limit "B", wear is very rapid, unless the heat dissipation ratio is increased by cooling.

Evidently, operation should be kept inside the proportional-wear range. Its over-all limit is generally believed to be 0.030 in.; but it is safer to select a lower limit of 0.020 or even 0.010 in.



***Case 1* . . UNDERSIZE ARBOR COST 43% OF NORMAL CUTTER LIFE . . .** on this miller. Work was stainless-steel forgings; and it looked as though the arbor had plenty of support from the overarm. But tests with a torsiograph and vibration meter showed angular velocity of the arbor to be anything but uniform. The small arbor wound up like a spring each time a cutter tooth hit the work. Heavier arbor increased cutter life 75%

How much is VIBRATION costing you?

Five case studies from industry, where the true causes of short tool life and damage to the work were found by instrumented vibration tests

There are three points about vibration in machine tools that are important. First, even though vibration is sometimes minor—almost undetectable—it can ruin good tools, and eventually good machines. Second, even well-designed machines can often develop vibration even though nothing in the setup is to blame—see the resonant-frequency example. The same case study illustrates the third point; vibration testing isn't necessarily difficult or expensive. That resonant-frequency problem took only 20 minutes to solve.

Equipment can range from a simple "strobe" light to torsiometers and velocity pickups and meters. It depends on what you're trying to find. Torsiometers, for example, are attached to rotating shafts, and indicate shaft speed on a graph. If the line is even, there's no angular vibration; but if the line jumps up and down, look for something that's making the rotary speed change. Velocity pickups indicate straight-line motion, like endwise chatter in a shaft, or longitudinal chatter in a table. Oscilloscopes put these results on a fluorescent screen.

These five examples are from the files of Consolidated Engineering Corp, Pasadena, Calif.

Case 2 . . PROBLEM OF RESONANT FREQUENCY

. . . Not all vibrations are caused by something actually "wrong" about the machine or the work. A machine doing straddle milling on aluminum castings produced a poor work finish and showed bad cutter life. The operator had set up speeds and feeds for carbide cutters, using his experience and best judgment.

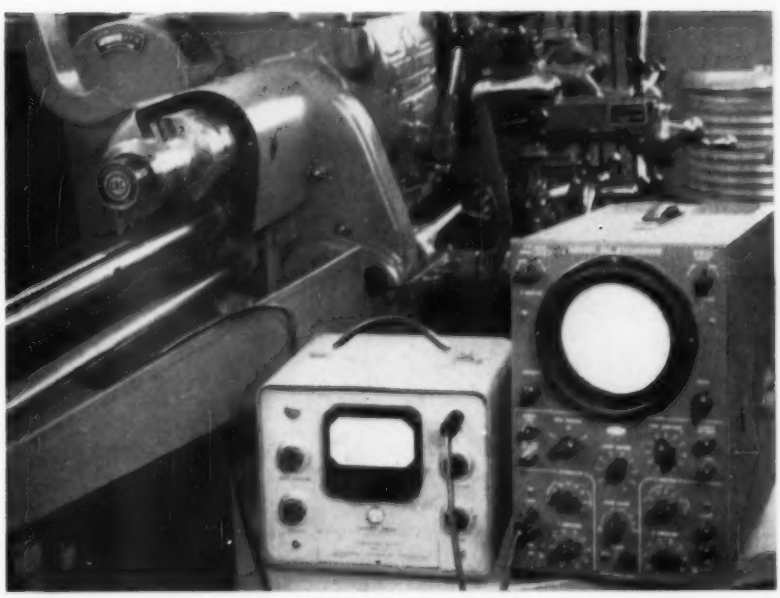
Engineers applied a torsiograph, vibration pickup, and oscilloscope to the machine, and immediately suspected that the vibrations were at some resonant frequency of the machine, or of a large casting in the machine. Vibration frequency was the same as the frequency with which cutter teeth made contact with the work.

First, they changed cutter speed until minimum vibration was noted. This eliminated the resonance, which multiplied the original vibration. Next, they changed the feed rate until vibration dropped almost to zero. Now surface finish was normal and cutter life extended.

To improve production, they took the full cut in one pass, jumping the rate 50%. This was possible because, without the vibration, the cutter could handle the load

Case 3 . . BADLY SET TOOLPOST CUT TOOL LIFE . . .

on this turret lathe. Work was 4130 steel. Vibration meter showed up vibrations at 600-700 cycles/sec (too fast to feel) with amplitude of only 0.0003 in. (too tiny to catch without meters). Toolpost was reground and seat lapped to eliminate the vibrations and restore tool life to normal



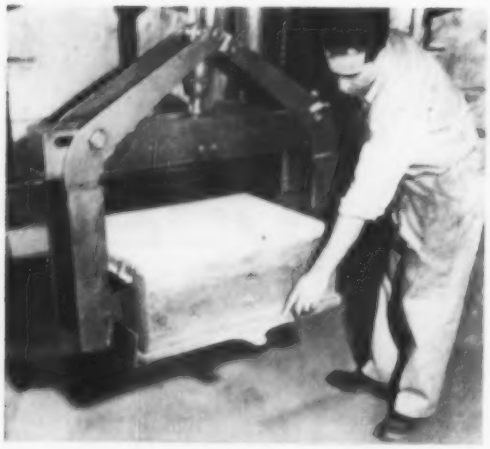
Case 4 . . WORN V-BELT IN TURRET-LATHE HEADSTOCK . . .

made work come out looking like it had embrittlement cracks, which was unlikely. Torsiograph was attached to work during cut, and showed pronounced rotary vibrations. This was traced to the drive belt, which had separated into layers. New belt eliminated the trouble

Case 5 . . SLIPPING DRIVE BELT RUINS FINISH . . .

On a surface grinder that couldn't be made to produce a decent finish, the first thing to check was the wheel—for unbalance. Using a stroboscopic light to "stop" rotary action, engineers checked the wheel, pulleys, and belt in the headstock. The wheel seemed OK, but it was easily seen under the light that the belt was slipping.

There was also another vibration, which was traced to the plant floor; it was caused by some external source. Therefore, the belt was tightened, and the machine remounted on vibration isolators. A final check with instruments showed a total vibration amplitude of only 0.00004 in., which was small enough to ignore



ORIGINAL ANNEALING BOX weighed 400 lb, required special lifting device. Edges of tray cracked frequently, required full-time attention of a welder. Lug at front is for push-bar for loading

LIGHTWEIGHT INCONEL BOX has removable handles, holds 25 bundles of laminations, weighs only 107 lb, but carries work load of 900 lb. Bottom of cover rests in sand seal trough in tray

Production UP . . . Handling time DOWN with new annealing boxes

Faster heating and easier handling, plus elimination of spoilage produce 100% increase in productive capacity

D BROOKE, Superintendent in charge of production
KOBZY TOOL CO., CHICAGO

Cumbersome handling methods, high equipment maintenance, and work spoilage were running costs sky-high in Kobzy Tool Co's heat treating department where small steel stampings are annealed. So management analyzed the situation with an eye to accomplishing two things: Cutting down the direct losses caused by equipment failure; and devising a completely new handling procedure to mechanize a primarily manual operation.

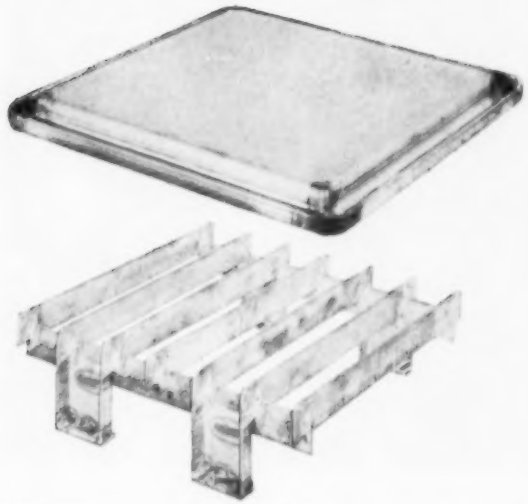
Both goals were reached by laying out a new materials-handling plan that was simple to put into effect, and by having a new lightweight annealing box designed that lent itself to easy handling, eliminated the work-spoilage problem, and actually doubled daily heat-treating production.

A big part of the problem lay in the old annealing boxes. They were made of heavy alloy and consisted of a two-piece hood and tray arrangement with a net weight of 400 lb.

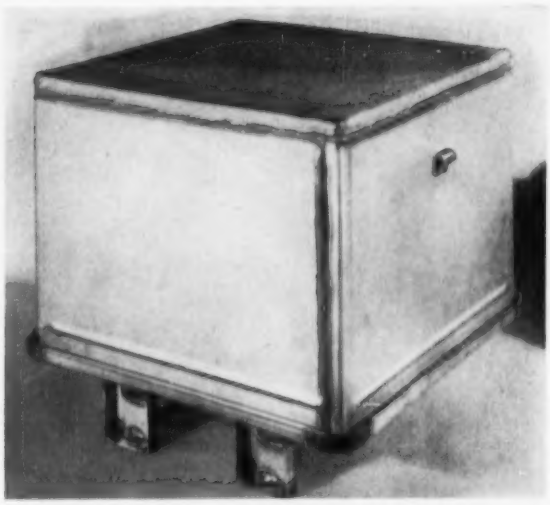
Frequently, after as few as three or four heats, the edges of the cast tray cracked, breaking the sand seal. This permitted hot furnace gases to circulate freely over the work, sometimes fusing the hundreds of small stampings into a solid mass. Repairing the cracks was a tedious maintenance chore that required almost the full time of one welder.

Because the boxes sat flat on the floor, with little or no clearance, they could not be loaded into the furnace by fork lift truck. This meant that pieces coming from the punch presses had to be loaded into tote boxes, carried to the furnace area, and there transferred to the annealing trays. After hoods had been put in place, boxes were raised to furnace level by a hoist, then pushed into the furnace with a manually operated rod.

To stop work spoilage and also to permit swifter and more efficient handling, Kobzy needed a specially designed annealing box that would meet rather rigid space and weight requirements and at the



GRID BASE provides free access for hot furnace gases to circulate under work tray, and legs give clearance for fork lift handling. Tray has integral sand seal, rests on grid. Lugs on side of hood are for removable handles for lifting



same time have the necessary high strength at elevated temperatures. The problem was solved by Chicago Boiler Co., Chicago, with the design and fabrication of a three-piece box of lightweight wrought Inconel. This particular alloy was chosen because of its high strength-to-weight ratio at elevated temperatures, resistance to corrosion and repeated heating and cooling, and ease of fabrication.

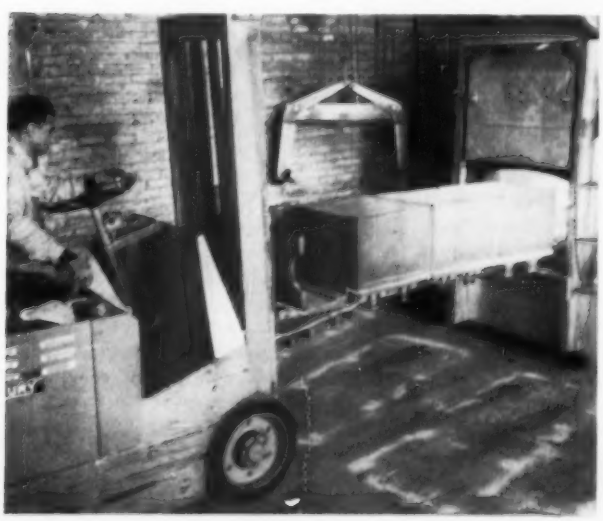
The box consists of a grid base with legs that not only keep the assembly off the floor for palletizing, but also permit circulation of furnace gases beneath the tray. The tray itself has a recessed integral sand seal that prevents leakage. The 35-lb hood can be lifted easily by detachable handles, and the whole assembly weighs only 107 lb yet carries a work load of 900 lb.

Under the new system, readying the boxes for charging is accomplished right at the press. As the pieces come off the press line, they are loaded directly onto the trays. A fork-lift truck then picks them up and transports them to the furnace area. To cut handling time to a minimum, a complete charge of three boxes is lined up in front of each furnace. In this way, one batch of boxes can be unloaded and a new batch charged in a matter of minutes.

Six hours are now required to bring the work up to 1475 F, where it is kept for 2 hr during the annealing cycle. Because the hood and tray are light gage, they heat quickly. Previous time was 12 hr. Similarly, cooling to handling temperature after removal from the furnace has also been cut appreciably, thus saving storage space.

The new method has now been in operation for about a year, and during this time not one of the 36 new-design Inconel boxes originally purchased has been out for repair.

Because of the perfected sand seal and elimination of cracking, work spoilage is no longer a problem. This alone has saved thousands of dollars in lost production. The light weight of the box, and the grid design that allows free circulation of furnace gases beneath the tray have been mainly responsible for a reduced heat-up time. This, coupled with the faster handling, has made it possible for Kobzy to run through three complete heats per day instead of the previous two. The new methods have effected a 100% increase in production capacity. Adding to this the fact that a costly maintenance job has been eliminated means that the company has already amortized the cost of the new boxes.



FORK LIFT TRUCK loads and unloads three boxes at a time. Gas furnace heats work to 1475 F in 6 hr, then soaks it for 2 hr. Work cools in sealed boxes to 200 F before hoods are removed

ALUMINUM SAND CASTINGS are ground on a wet-belt machine to a fine, straight-line finish with a silicon-carbide belt at a rate of 12 per min. Fixtures are not required, and parts are easily handled

MANUAL DRY GRINDING of steel fabric plates for tire molds requires only 25 to 30 sec for ⅛-in. stock removal, needs no tools or fixtures. Parts were formerly milled, required 12 min

CUT COSTS, INCREASE PRODUCTION, BY

Platen grinding with abrasive belts

JOHN A SIMMONS, product manager, THE ENGLEBERT HULLER CO, SYRACUSE, NY

Although far from a newcomer in Metalworking, the platen method of abrasive-belt grinding is now beginning to influence the design of components to take advantage of the manufacturing economies it offers. Parts formerly processed on lathes, milling machines, shapers, or cylindrical or disk grinders may frequently be handled on a belt grinder at faster stock-removal rates with minimum stock allowance, and freedom from burrs, clamping strains, and heat-distortion. With automatic feeds and simple fixtures, production rates on some parts can reach 10,000 pieces per hour.

There are five primary types of abrasive-belt machines—platen, formed-wheel, flexible-belt, centerless, and contact-wheel—but all consist essentially of drive and idler pulleys supporting and driving an endless belt. The platen type employs a platen, or backing plate, to support a straight section of belt on which the work is surfaced.

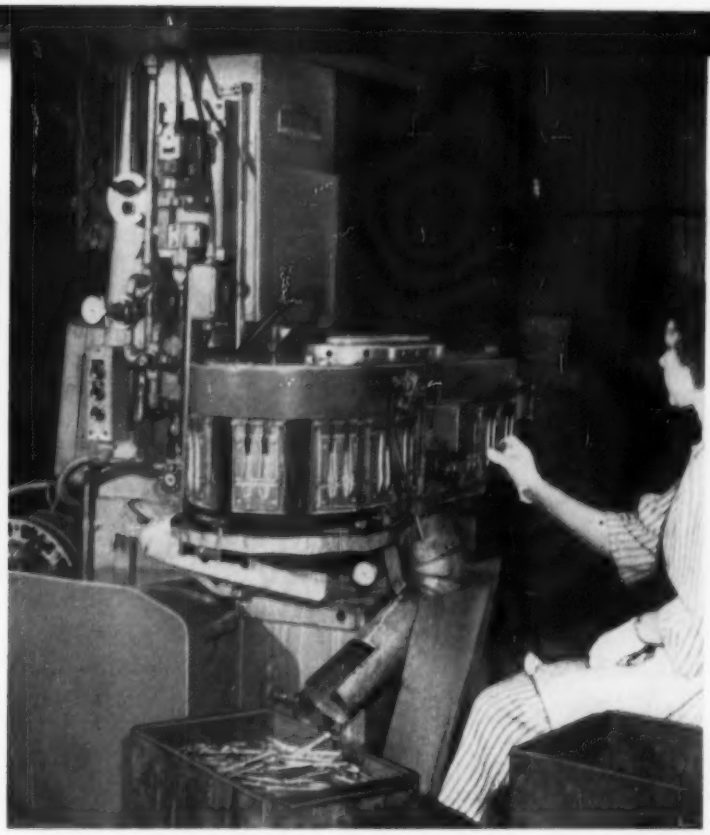
DRY-BELT GRINDING

Although used primarily for nonmetallic materials, such as wood, cork, rubber, and thermosetting plastics, dry-belt platen grinding can be used to good effect for light surfacing of ferrous and nonferrous materials. Especially practical for grinding surfaces which have no definite relation to other dimensions, the method can often be employed freehand, without jigs or fixtures, although adjustable angle gages on machine tables will permit squaring-up, chamfering, and generating curved surfaces. Limiting factors are excessive heat, dust, and belt loading, but, within these limitations, only glass and thermoplastic materials are entirely excluded.

WET-BELT GRINDING

Development of electrostatic coating methods and of extremely hard abrasives, such as silicon carbide, provided a belt with maximum cutting ability. Plastic adhesives made possible heat-resisting bonding of the abrasive, while rendering the belts impervious to continuous application of coolants, thus removing the limitations of the dry-belt method.

Wet-belt platen grinding is particularly effective for parallel surfacing of ferrous and nonferrous materials, and for work requiring extreme flatness or close dimensional accuracy. It is especially good on nonferrous materials because the coolant system



POWER-OPERATED WORK FEEDER has 21 fixture plates revolving on parallel roller chains. Knife handles are manually loaded into plates, finish ground at 2400 per hr, and automatically ejected into tote boxes

It's a fast, efficient method of stock removal that gives a good finish and doesn't overheat the work. But to get the most out of it, design your product with the process in mind; you may save 50% or more in weight

AUTOMATIC TABLE on Engleberg machine has rapid advance and hydraulically controlled variable feed rate. A micrometer stop regulates the amount of infeed and maintains uniform depth of cut

prevents chips from lodging between the abrasive grains. In addition to application at the grinding area, coolant is pressure-sprayed on the belt, inside the machine, to insure sharp, free-cutting abrasive action and uniform finish. Even material of low fusion points, such as thermoplastics, are readily ground with a wet belt.

PLATENS

Accurately machined, hardened-steel platens permit precision grinding to within 0.001-in. flatness and, normally, ±0.001.-in. parallelism. Adjustable platens insure dependable squaring with the table, and may be moved up or down to present a fresh, flat working surface to the job. Reversible plates double platen life and, when worn, can be removed and trued up.

For grinding work that has a slight curvature, or inside radius, padded platens can be used to advantage. Fabric-covered, they are well adapted to blending ground surfaces with unground portions, and for finishing surfaces that are not quite flat but where it is important that the entire surface be reached by the abrasive.

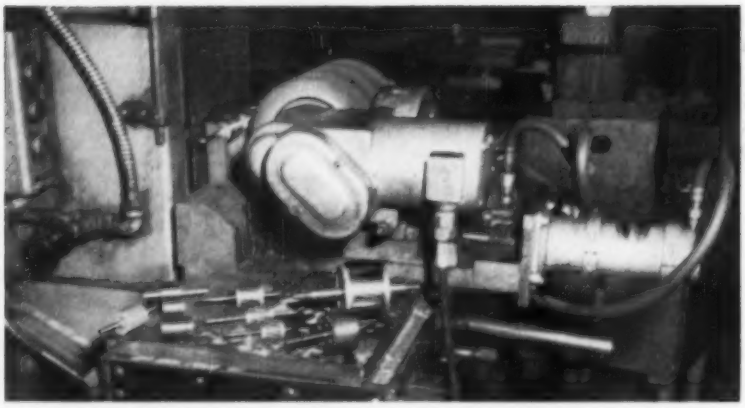
FEED ARRANGEMENT

A major requirement in belt grinding over a platen is that sufficient pressure be exerted to make the belt cut properly. Although coolants permit heavy stock removal, shallow cuts are generally preferable. For maximum economy, stock removal on nonferrous materials should not exceed 1/16 to 1/8 in., or 1/32 to 1/16 in. on ferrous parts.

Automatic control of pressure and feed rate will relieve the operator of the manual labor involved and permit him to speed up the loading and unloading cycle. Automatic feeders require only a minimum of setup and changeover time, and contribute greatly to the short-run flexibility of the machines. Furthermore, on either long or short runs, they tend to maintain a controlled, uniform finish.

Because working pressure is constantly downward, over the whole grinding area, and outward toward the fixture, simple, inexpensive holding de-

Platen grinding with abrasive belts . . .



HIGH-SPEED ROTARY GRINDING of small rotors is performed by holding shafts in V-blocks, rotating work against platen by regulating wheels. Concentricity is held within 0.0002 in. Pneumatic fixture is mounted on hydraulic in-feed table of machine

vices are usually adequate. However, they must be designed for rapid loading and unloading because most grinding operations are fast—seldom take more than 30 sec per part.

For multiple loading, stagger the parts or arrange them obliquely to utilize maximum platen area and improve cooling. If parts have bosses, do not arrange them so one boss comes directly over another. If parts are small, and flat on both ends, a turnover fixture may be an advantage.

A slightly resilient covering, such as a layer of firm rubber, on work-supporting surfaces is frequently an advantage. Burrs or other raised surfaces on the work will sink into such a covering and the location of the work will not be affected. It also provides a uniform support for the work and tends to increase platen and belt life.

PRODUCT DESIGN

To take maximum advantage of platen-type belt grinding, design work with the process in mind. Do not allow the area to be finished to exceed 30 sq in. on soft metals; half of this on iron and steel. If bosses or other interrupted surfaces can be employed to reduce the total exposed area, much larger parts can be handled.

The amount of time a given area of the grinding medium is in contact with the work is much less than with other cutting tools. And not only is the contact area much larger, but the total length of the revolving belt is 8 to 10 times the height of the platen. Moreover, the rapidity of the grinding cycle permits sharper cuts with less pressure on the work than is required for milling or disk grinding. Cutting is not concentrated on a small contact area, so the heat generated is easily dissipated by the use of coolants. This means that heat distortion, particularly on castings, need not influence part design, and hence, wet-belt grinding will permit reductions in wall thickness, greater surface indentations, and minimum stock allowances. Pre-designing parts for belt grinding may reduce weight by as much as 50 to 75%, with added benefits in increased production rates and longer belt life.

RECOMMENDED ABRASIVES AND OPERATIONS FOR WET-BELT GRINDING ON VARIOUS MATERIALS OVER A PLATEN

MATERIAL TO BE GROUND	ABRASIVE	GRAIN SIZE ROUGHING	GRAIN SIZE FINISHING	BELT SPEED sfpm	PRESSURE OF WORK AGAINST BELT	COOLANT
Aluminum and Brass	Silicon carbide	36 to 80	120 to 240	4600 to 5500	Light	Soluble oil in water (40 to 1) or grinding oil
Copper and Lead	Silicon carbide	60 to 80	120 to 240	2550	Very light	Soluble oil in water (40 to 1)
Cast Iron	Silicon carbide	24 to 36	60 to 80	2550 to 3550	8 psi (New Belt) 25 psi (Old Belt)	Plain water
Soft Steel	Aluminum oxide	36 to 60	120 to 180	3550 to 5500	8 psi (New Belt) 25 psi (Old Belt)	Soluble oil in water (30 to 1) or grinding oil
Hard Steel	Aluminum oxide	40 to 80	120 to 180	3550 to 5500	Heavy	Soluble oil in water (30 to 1) or grinding oil
Glass and Ceramics	Silicon carbide	36 to 80	180 to 320	2550 to 3550	Light	Plain water
Plastics	Silicon carbide	80 to 120	320	2550 to 3550	Light	Plain water

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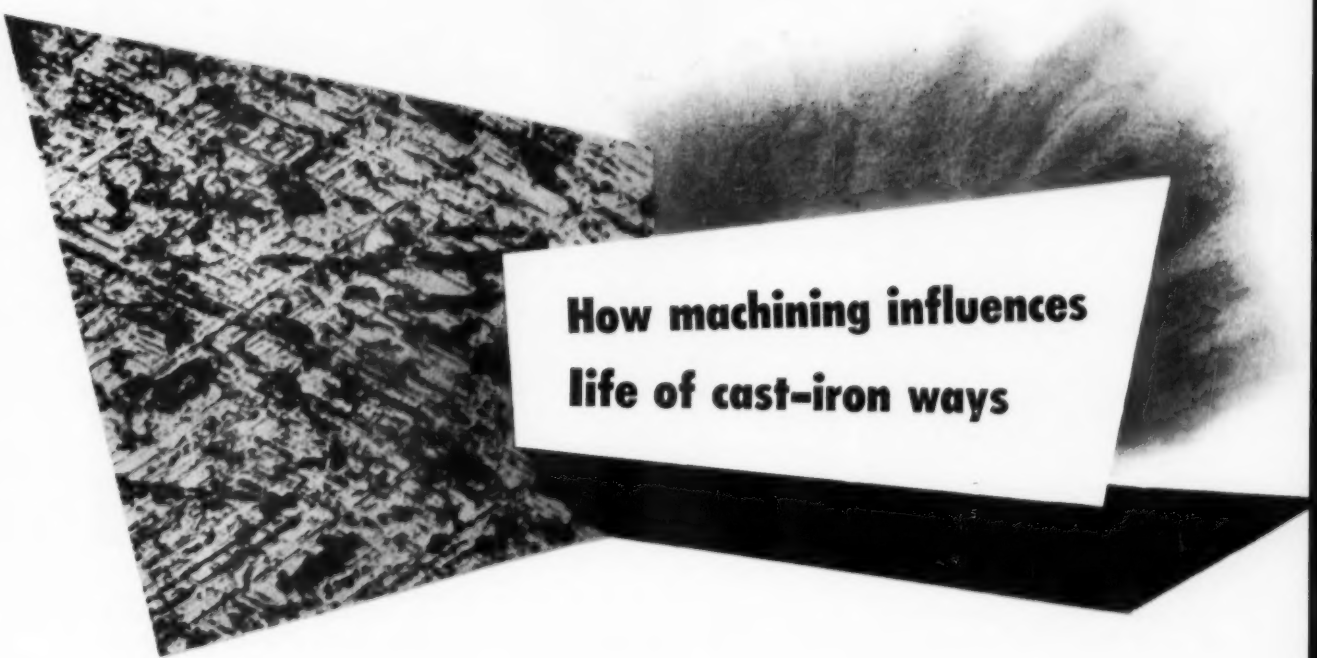

How machining influences life of cast-iron ways

DR C R AUSTIN, assistant to the president,
MEEHANITE METAL CORP, NEW ROCHELLE, NY

Scratching and scoring of machine-tool ways are a frequent problem. Here are the results of two series of tests conducted by Dr Austin as the result of difficulty with cast-iron shaper ways. The tests make two major points:

1 . . Machining may be a major cause leading to scoring of ways.

2 . . This source of the trouble can be eliminated by proper machining methods.

In addition, the report demonstrates a new technique—a modified metallographic examination—for studying the finish of machined surfaces. The new method reveals minute cracks and checks not disclosed by conventional surface-finish measurements

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How machining influences life of cast-iron ways . . .

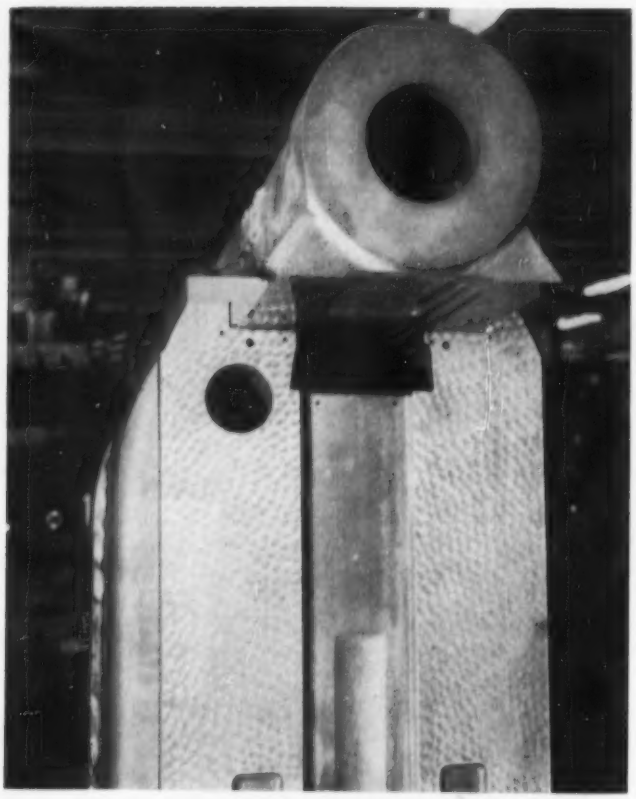

FIG 1 . . Ram and frame of shaper assembled for run-in period. Scratching and scoring of ways, both on ram and frame, have been a problem at this time

A great deal has been written on friction, galling, and seizing of mating metal surfaces with particular emphasis directed toward material selection, method of surface finishing, type of lubrication, and the role of the running-in or breaking-in period.

It is the purpose of the present report to examine, define, and illustrate the nature of the "as-machined" surfaces. The research was instigated when one machine-tool manufacturer, who has continuously used Meehanite metal for many years, occasionally ran into scratching and scoring problems on both ram and frame in shaper ram guides.

PRELIMINARY STUDIES

Several investigations had been conducted in the plant and a number of experimental measures established in an attempt to minimize scratching. Thus, an experimental ram was chrome-plated after finish grinding. After use on an industrial shaper in the toolroom for 2½ years, it was still in excellent condition.

Two frame ways were experimentally treated with Parco-Lubrite, a process which leaves a thin deposit of iron phosphate on the machined surface. However, treatment of the frame seems impractical because it must be done after finish scraping with the base bolted to the frame, making an unwieldy part to handle. Treatment of the frame would be more beneficial than treatment of the ram because feather edge left from scraping is removed during the process.

Installation of a Purolator micronic paper filter was adopted as a regular procedure during the run-in period. These filters only reduced scratching a slight extent, although the oil (as seen through the ram-wedge oil-sight glasses) was considerably cleaner after installation of the filters.

Comparison of surface finish of the materials examined in these tests was checked by JEV probe and compared to surface finish blocks, see Table 1.

A procedure of coating ram ways with Molykote Type Z,

table 1 . . SURFACE FINISH OF RAMS IN PRELIMINARY TESTS

	Checked parallel with direction of motion	Checked at right angles to direction of motion
Milled ram	64 mu in.	32 mu in.
Ground ram	16	32
Chrome-plated ram	8	16

an anti-seizing compound, was adopted temporarily after finish scraping prior to running-in on the assembly floor. This practice appeared to help reduce scratching.

Consultation with other machine-tool companies produced no definite method to eliminate scratching and scoring. One company suggested that scoring may be caused by loose grains embedded on the ground surface and recommended a slightly harder grade of grinding wheel that would not break down as easily and consequently less loose grit would be available for causing the difficulty.

The grinding-wheel company that furnished the wheels totally disagreed with these premises and recommended no change in the wheels furnished.

The representative of one large machine-tool company could not say definitely that at all times a milled surface is superior to a ground surface, but pointed to one advantage of the milled surface: tool marks will be almost perpendicular to the direction of motion. When oil is trapped in these slight depressions, it has a tendency to distribute oil across the entire bearing surface. In comparison, grinding marks are usually parallel to the motion and thus do not distribute the oil.

As a result of a careful study of examples of the finish milled and finish ground rams, it was found difficult to make any concrete recommendations without further study of the problem.

Because scratching and eventual scoring of shaper ram and guides have always been a problem, two series of tests were made in an effort to learn more about the problem.

Freedom from scratching and scoring is dependent on many factors, including materials selection, machining operations, surface finish, and on care in assembling the units to assure freedom from grit, etc, with proper lubrication.

This study, however, was directed entirely to the relation of machining procedure to the characteristics of the surface of the metal.

The conventional method used to define surface finish is the Profilometer, but it was considered that microscopic examination of the nature of the surface might reveal details generally overlooked.

Accordingly, the machined samples were subjected to study under the microscope after varying degrees of surface polishing and photographic records were made of the characteristics observed.

Test Series No. I

It was arranged to prepare milled, ground, and scraped finished samples of engineering types of Meehanite metal, Table 3. After final preparation, they were checked for surface finish with a Profilometer, see Table 2.

The specimen blocks were 6 x 4 x 2 in. and the machined finishes were obtained by making several light cuts. The procedure consisted of:

1. Initial rough milling of all three blocks.
2. Finish grinding, milling, or scraping, as indicated under surface finish. These were said to be "light finish cuts."

The most significant data was obtained from a thorough examination of the characteristics of each of the prepared surfaces:

1. In the finish machined condition after thorough cleaning with carbon tetrachloride.
2. After subsequent light grinding and polishing.

The amount of material removed in this subsequent light metallographic grinding and polishing was

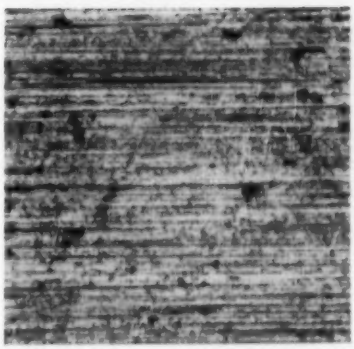

FIG 2A . . Ground test block at 50X

FIG 2B . . Milled test block at 50X

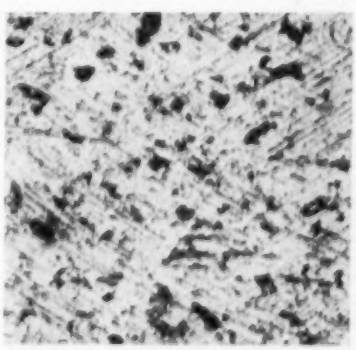

FIG 2C . . Scraped test block at 50X

table 2 . . SURFACE FINISH OF SERIES I TEST BLOCKS

Specimen	Parallel with direction of motion	Right angles to direction of motion
Milled block (GC) ram	20-25 mu in.	20 mu in.
Ground block (GB) ram	10-14	30-35
Scraped block (GB) frame	30-40	30-40

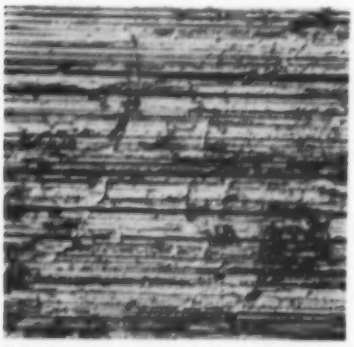

FIG 3A . . Ground block (same as 2A) at 250X

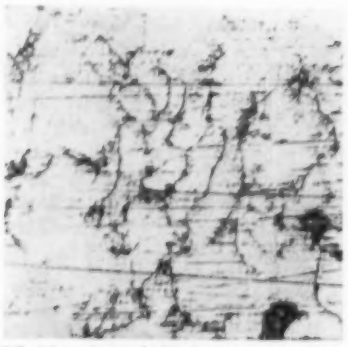

FIG 4A . . Ground block (same as 2A, but polished) at 250X

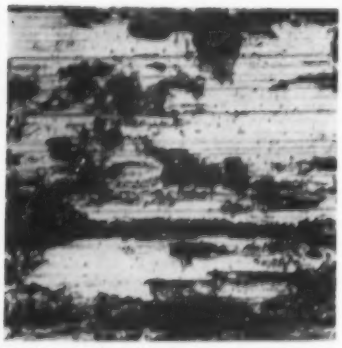

FIG 3B . . Milled block (same as 2B at 250X

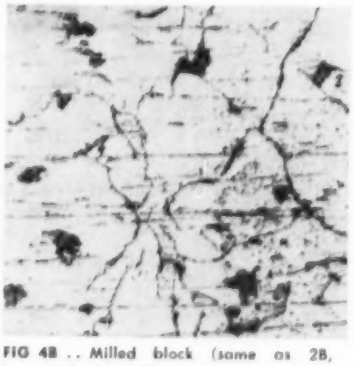

FIG 4B . . Milled block (same as 2B, but polished) at 250X

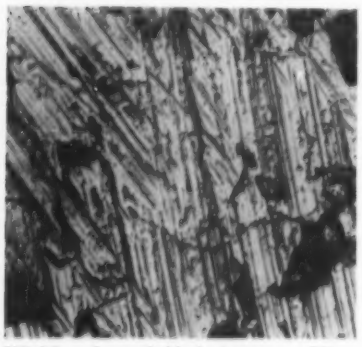

FIG 3C . . Scraped block (same as 2C) at 250X

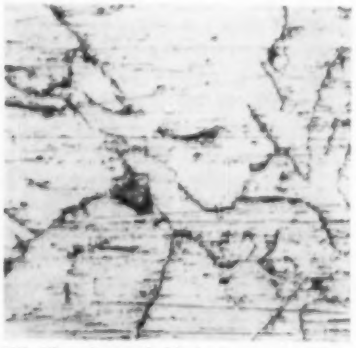

FIG 4C . . Scraped block (same as 2C, but polished) at 250X

insufficient to remove the original scratches produced by the finish machining operations. Fig. 2A, 2B, and 2C, respectively, illustrate the appearance of the surfaces at 50-diameters magnification after grinding, milling, and scraping. Evidence of surface cracks is clearly revealed on the ground section but the milled and scraped surfaces show evidence only of considerable surface working.

At 250 diameters magnification, the development of cracks by grinding (Fig. 3A) is clearly observed and Fig. 3B and 3C illustrate more readily the disturbed surface characteristics of the milled and scraped blocks. It should be mentioned, however, that with this higher magnification, the resolution of the optical lens system used is sufficient to reveal surface cracks on the scraped block.

Sections of each of these three blocks were then lightly ground on No. 000 emery paper and wet polished, and records taken again of the structures at 250 diameters magnification. The fact that only a limited amount of surface had been removed by grinding is indicated by the presence of the scratches associated with the final shop machining or grinding operations.

Fig. 4A, 4B, and 4C clearly support the statement that all three blocks exhibit surface cracking resulting from some phase of the machine-shop operations. Thus it is suggested that the cracks illustrated on the scraped section (Fig. 4C) while presumably not associated with the actual scraping, were developed during the prior milling or grinding of the metal.

The results of this examination materially contributed to a general analysis of this problem and it became clear that immediate consideration should be given to more clearly defined machining operations and their relation to the surface cracking which had been developed on each of the three blocks submitted.

table 3 . . PROPERTIES OF SERIES I TEST BLOCKS

Meehanite	Tensile, psi	Modulus of elasticity, psi	Endurance limit,psi	Brinell, min
Type GC	40,000	17,000,000	17,500	192
Type GB	45,000	18,000,000	19,000	196

COMMENT ON SERIES I

The results of these tests were brought to the notice of one of the senior engineers in the automotive industry and his attention was di-

rected to the photographs illustrating surface cracking on milled, ground, and scraped surfaces of unhardened materials. It was no surprise to this expert, who explained that all machining causes cracks or ruptures of material to a greater or lesser extent. Even filing by hand, he affirmed, will cause materials to be torn or cracked, and most machining operations will smear the material near the surface to a considerable extent.

He stated that the cracking is basically caused by the instantaneous expansion of the piece being machined or ground, which is immediately followed by contraction as the material cools, whether a quenching medium is present or not. He suggested that in the case of grinding, damage to the surface can be minimized by using an excessively soft wheel, although shop men are reluctant to use soft wheels because they break down so rapidly and require more frequent dressing.

He stated further that flat-wheel grinders are much more conducive to cracking than is the case when the periphery of a wheel is used, such as on ordinary cylindrical grinders. Often the cylindrical portions of shafts are ground with few if any cracks, but when the shoulder is ground with the side of the wheel, it may be covered with cracks. He particularly objected to excessively smooth surfaces in mating metal parts and preferred the machining marks at right angles to the direction of motion to which the piece would be subjected in use.

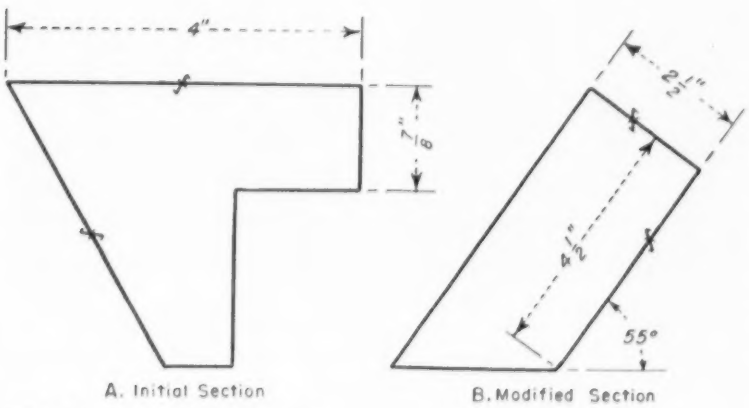

FIG 5 . . Ram wedges for Test Series II

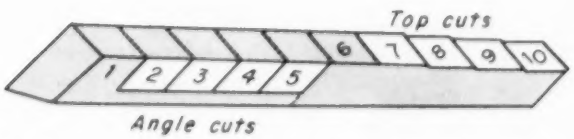

FIG 6 . . First test wedge, showing location of angle and top cuts. Section 1 was left as cast, 2 to 5 were rough cut, 3 to 5 received a second rough cut, 4 and 5 were semi-finish milled, and 5 was finish milled. Section 6 was left as cast and section 7 to 10 received the same sequence of operations as 2 to 5

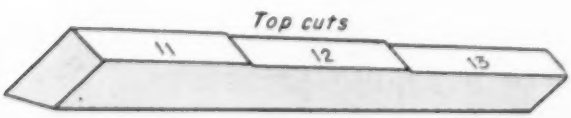

FIG 7 . . Second test wedge was machined with very light cuts on the as-cast top face. Section 11 was machined only in a shaper, section 12 in a grinder, and section 13 in a milling machine

Test Series No. II

Specially prepared blocks of iron castings (49,000 psi tensile Meehanite type GB) were poured from one ladle of iron to assure complete similarity of product, and subjected to different, clearly defined, machining procedures in order to establish whether or not surface cracking inevitably resulted from the machining operation.

It will be noted, on reference to Fig. 5A, that the samples prepared were ram *wedges,* not the ram proper, the purpose being to select samples of an economical size, yet representative of the ram material. It was agreed, however, to modify the shape of the castings in order to eliminate any possibility of slight variation in metal as a result of section and change in cooling rates. The new sections were essentially rectangular, maintaining only the 55° angle on one side, as shown in Fig. 5B.

One of these wedges was machined, as indicated in Fig. 6 so that the various segments were finish machined according to the following procedure, on the angle or side:

Section 1	Left as cast
Sections 2 to 5	First rough cut . . Then
Sections 3 to 5	Second rough cut . . Then
Sections 4 and 5	Semi-finish mill . . Finally
Section 5	Finish mill

The other half of this wedge was also segmented in the machining operation and segments 6 to 10 treated with a top cut, in sequence as shown above. Thus section 6 was as-cast and section 10 was first

How machining influences life of cast-iron ways . . .

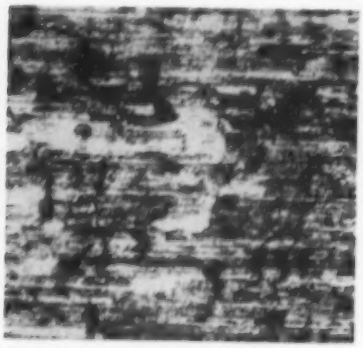

FIG 8A . . Shaped section (11 in Fig 7) at 50X

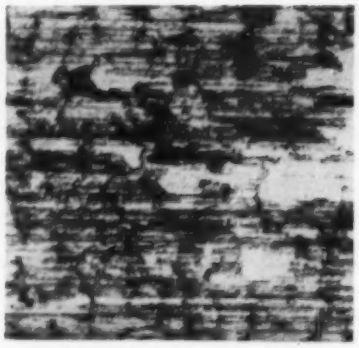

FIG 8B . . Ground section (12 in Fig 7) at 50X

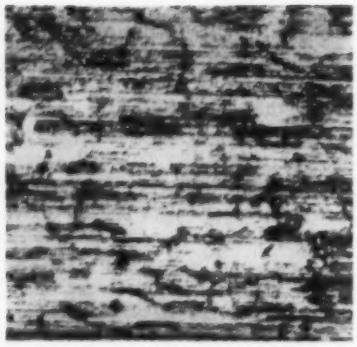

FIG 8C . . Milled section (13 in Fig 7) at 50X

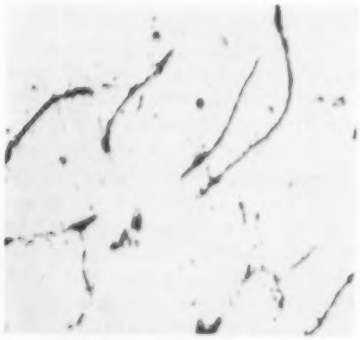

FIG 9A . . Shaped section (Fig 8A polished) at 250X

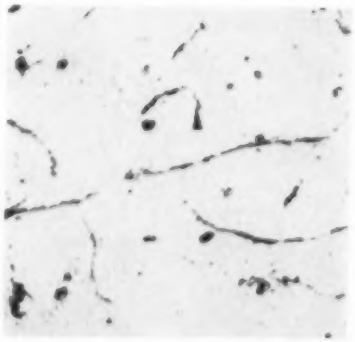

FIG 9B . . Ground section (Fig 8B polished) at 250X

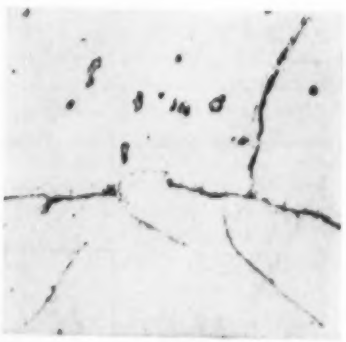

FIG 9C . . Milled section (Fig 8C polished) at 250X

table 4 . . MACHINING DETAILS FOR TEST SERIES II

Sample No.	Operation	Stock removed, in.	Cutter Type	Cutter Dia, in.	Cutter No. blades	Cutter speed rpm	Cutter speed sfpm	Feed, ipm	Chip per tooth
1	Leave rough casting	—	—	—	—	—	—	—	—
2	Rough mill No. 1—angle	¼	Rexalloy*	9½	12	43	100	7	0.012
3	Rough mill No. 2—angle	0.030	Rexalloy*	9½	12	52	120	8	0.013
4	Semi-finish—angle	0.004/0.006	Carbide 999	5	12	444	550	25	0.005
5	Finish—angle	0.003	Carbide 999	5	12	444	550	15	0.003
6	Leave rough casting	—	—	—	—	—	—	—	—
7	Rough mill No. 1—top	¼	Rexalloy	5	10	52	70	12	0.015
8	Rough mill No. 2—top	0.030	Carbide 44A	5	9	282	370	15	0.007
9	Semi-finish—top	0.004/0.006	Carbide 999	5	12	444	550	25	0.005
10	Finish—top	0.003	Carbide 999	5	12	444	550	15	0.003

* *Dovetail cutters. Other tools were face-milling cutters.*

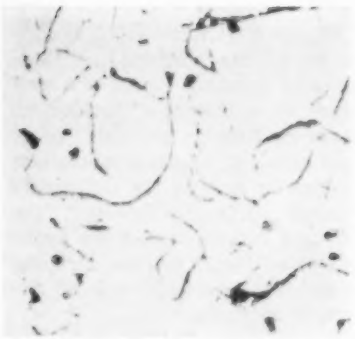

FIG 10A .. Rough milled angle cut (2 in Fig 6 polished) at 250X

FIG 10B .. Finish milled angle cut (5 in Fig 6 polished) at 250X

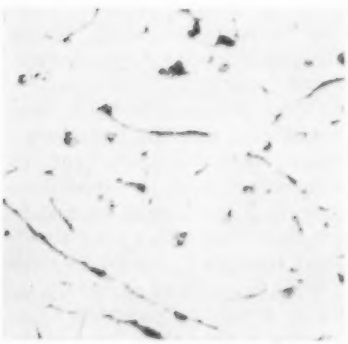

FIG 11A .. Rough milled top cut (7 in Fig 6 polished) at 250X

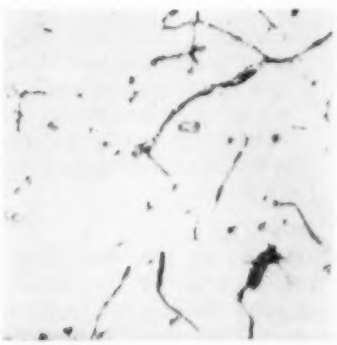

FIG 11B .. Finish milled top cut (10 in Fig 6 polished) at 250X

rough cut, second rough cut, semi-finish milled, and finish milled.

Metal sections 2 and 3 were both cut with dovetail cutters using the slab or side of the milling tool. Sections 4 and 5 were face milled in the semi-finish and finish mill operations.

Metal sections 7 to 10 were face milled throughout.

The second ram wedge (Fig. 7) was machined with only very light cuts on the as-cast top face of the wedge; section 11 was machined only in a shaper; section 12 in a grinder; section 13 in a milling machine.

All the work was done dry with the exception of grinding. While no record was kept, it was indicated that the grinding was done with water cooling.

Table 4 shows the machining details and Table 5 the surface finishes obtained, as gaged by Profilometer readings. The Brinell hardness values were taken on the finished surfaces. Specimens 1 and 6 were, of course, representative of the as-cast surface condition.

The appearance of the surface of samples 11, 12, and 13 in the as-machined condition are reproduced at 50-diameters magnification (Fig. 8A, 8B, and 8C). Whether light-finished shaped, ground, or milled, there would appear to be an essential absence of surface checking or cracking. This conclusion is verified on examination following light grinding on No. 000 emery paper followed by wet polishing. Very little material was removed in surface preparation and some of the original machine marks are still evident. The photo-micrographs of the surfaces (Fig. 9A, 9B, and 9C) are reproduced at 250 diameters.

If a comparison is made between Fig. 9 and 4 the profound difference in susceptibility to surface checking as a function of machining procedure is at once evident.

Comparison was then made of surface appearance of angle cuts subjected to an initial rough milling (Fig. 10A) and to subsequent second rough cut, semi-finish and final light finish cut (Fig. 10B). The structures of the machined surfaces at 50 diameters had shown complete absence of surface cracking. This is confirmed on referring to the polished surfaces photographed at 250 magnification (Fig. 10A and 10B).

Similar examination of the top cuts, samples 7 to 10, was made and the rough-milled and finish-milled surface appearances are illustrated in Fig. 11A and 11B. Again complete absence of surface checking is apparent.

It seems clear that no surface cracks were found in this second series of tests, lending support to those who do not believe that all machining causes cracks or ruptures of material.

The results of these series of tests indicated:

1. Either the machining operations or the metal characteristics were responsible for surface cracking in Test Series I.
2. Neither the mode of machining nor the metal characteristics resulted in surface cracking in Test Series II.

General Conclusions

Many factors have been assigned as the cause for scratching and scoring and it is certain that the character of the metal selected and the method of surface machining are not always the direct cause of this problem, a common one in the machine-tool industry.

On the other hand, there is no doubt that materials selection and metal surface finish can be of paramount importance and it was the purpose of this examination to study one phase of the problem, namely the relative tendency for the formation of surface cracking in relation to specific machining

table 5 . . SURFACE FINISH OBTAINED IN TEST SERIES II

Specimen No.	Final machining operation	Type of cut	Finish, mu in.	Brinell hardness
2	Rough mill No. 1	Angle	40-80 irregular	204
3	Rough mill No. 2	Angle	60-100 irregular	196
4	Semi-finish mill	Angle	30-45	198
5	Finish mill	Angle	35-45	207
7	Rough mill No. 1	Top	100-150	199
8	Rough mill No. 2	Top	40-60	202
9	Semi-finish mill	Top	40-60	196
10	Finish mill	Top	40-60	207
11	Shaped—very light cuts	Top	40-50	196
12	Grind—very light cuts	Top	40-60	199
13	Mill—very light cuts	Top	30-35	194

procedures and surface finishing operations.

It has never been practical over the several decades of the modern machine-tool industry to readily define cause and effect despite the voluminous literature published, of scratching, scoring, galling, and seizing. Troubles are generally "epidemic" in character and frequently the solution is ill-defined and may even pass without any obvious or recognized change in material or *modus operandi*, only to recur at some future date without any apparent change in factors thought to promote scratching and scoring. Thus during the present investigation the problems which led to this study seemed to gradually resolve themselves without it being possible to define any particular solution.

However, while there is no doubt that many factors can be contributory, as indicated in the early part of this report, there is similarly little doubt that one vital factor which warrants recognition and attention is the effect of the machining on the nature of the prepared mating, sliding surfaces. Pronounced surface cracking can have a deleterious effect, primarily because:

1. Cracks provide opportunities as carriers for machining and grinding particles and any foreign material associated with the assembly and operation of the machine, including the effect of the lubricating system.
2. Cracks materially reduce the resistance to surface fatigue of a material and lead to surface disintegration with the liberation of fine metal particles which can immediately promote scratching and scoring.

ADVANTAGE OF THIS TEST METHOD

The investigation has demonstrated the use of a new technique to examine susceptibility to surface checking. It has shown that the more conventional method of the examination of polished transverse sections, cut at right angles to the machined surface, can often fail to reveal localized surface cracking. However, examination at various magnifications directed on the machined face actually provides an opportunity to reveal and record any changes in surface characteristics in the as-machined state and particularly after progressive fine metallographic grinding and polishing.

Thus in Test Series No. I, examination of the machined surfaces revealed grinding cracks and evidence of a disturbed surface on either milling or scraping. After light polish-grinding, cracking was evident on each of the differently finished surfaces. However, the grinding cracks seemed to penetrate most deeply whereas scraping tended to eliminate some of the surface checking.

The surface finishes resulting from methods of machining used in Test Series I are obviously readily susceptible to surface fatigue and surface disintegration. Minute metal particles released under conditions of sliding friction, subjected to normal loading, would immediately result in some scratching and possible scoring.

In Test Series No. II, it was demonstrated that the test blocks, prepared from Meehanite Type GB and machined under the conditions defined in Table 4, were essentially crack-free from the initial rough milling through to the final finishing with fine milling, grinding, or shaping. It may be recorded, however, that a change in the method of finishing rams was inaugurated some time after the results of Test Series I were available. Thus, special carbide cutters were ordered to improve the finish obtained by milling.

The results are extremely significant in revealing the importance of correct tool selection and in defining the required details of machining to produce a crack-free metal surface having minimum susceptibility to surface fatigue with freedom from scratching and scoring.

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Round Table

Coffee Break, Work Broke

"One of these days we'll have to go out and buy whips, just to make sure the employees do a little work before they go home, Al. Did you hear about the new 'official' coffee break they're getting?"

"I just read the memo, Ed. But I can't say I'm surprised. The union was on the verge of making a demand about it, you know."

"Sure; the company beat them to it, and gets credit for being nice. But how much of this can we stand? I thought the company was in business to make money, but it beats me how they can show a profit if practically every minute of the day is a break of some kind."

"I know, Ed; things are getting more liberal all over, and about all we can do is keep up with them."

"Listen, Al; if I get any work out of my department before 8:30 in the morning, it's strictly an accident. They have to talk over last night's TV programs for at least half an hour. How the hell are we going to keep up production with that going on?"

"Oh, it's not as bad as that, Ed. I was just reading in the paper about some kind of survey they made on companies that have coffee breaks. I think it was something like 60% claimed they got higher productivity because of the break, and some of them said their labor turnover was lower."

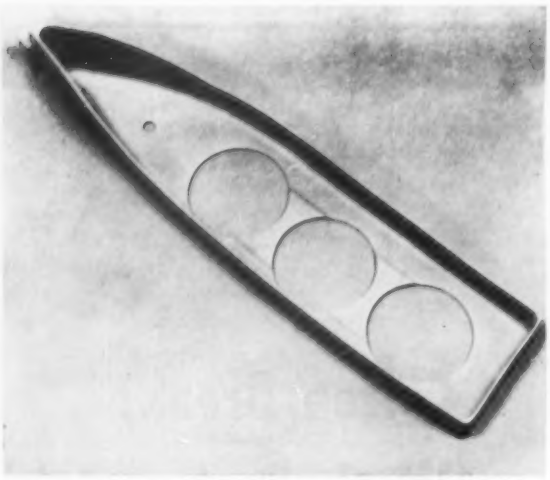
"That's fine; but how can you make up for two or three hours' loss of time by slightly higher productivity in the few hours left in the day. I tell you somebody's got to stop this crazy trend, or we'll all go out of business."

"You can't back up a trend like this one, Ed. If the workers don't get liberal treatment they'll go someplace else. It's up to us to make sure they don't waste the time they do work, and to see that they have equipment that raises the output."

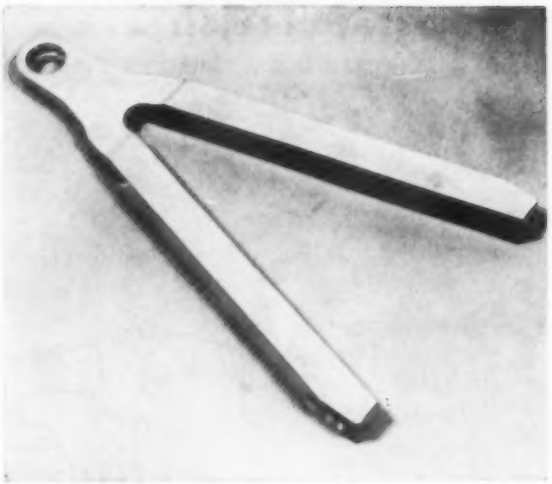
"Then the only thing we have to look forward to is running a plant without any people at all—just machines that don't need coffee breaks or time out for games."

"It may come close to that, eventually, Ed. Meantime, we've got to roll with the punches."

***DO** more relaxed working conditions help output, or are things actually getting too sloppy? Will the current trend keep going on and on, or will it reach a point of reasonable balance? Your opinions can help others. Discussions of earlier topics start on page 172.*



"POCKET PART", machined from an aluminum-alloy forging, requires only roughing and finishing cuts. It is roughed in 2 min outside, 6 min inside, and 8 min. to cleanout. Finishing cut requires 20 min outside and inside, 13 min to step bottom, and 8 min to step flange, for a total of 57 min. By utilizing an A5 miller, production was doubled over earlier use of conventional profiling methods



"SLING SHOT" periphery is machined on a tracer-control-adapted mill in 19 min. Time on a conventional profiler was 2 hr 50 min. However, the latter included setup

EXPERTS TELL

How contour controls solve shop problems

Machine development for tracer duplicating by milling or profiling is receiving wide attention in the aircraft industry as well as in other facets of Metalworking. Some of these machines are production models built for the job, some are conversions of older, even obsolete, machines, and some are especially built for a specific problem. Opinions vary as to choice and application. One thing is certain, this technique is an important consideration in methods planning and in tool engineering.

Douglas Aircraft's supervisor of machines and methods development, W B McKay, typifies the interest as he tells how his company converted one machine on an experimental basis. This machine was rebuilt, using a surplus miller, from design concept to the first milling cut in 120 days, at a cost of $23,000. Many ideas were tried, such as rods instead of gibs, ball-bushing bearings, traveling carriage with package power unit, spindle-cooling systems, pressure lubrication, and a three-dimensional-tracing valve in a lightweight aluminum housing with all controls at the front for operator convenience.

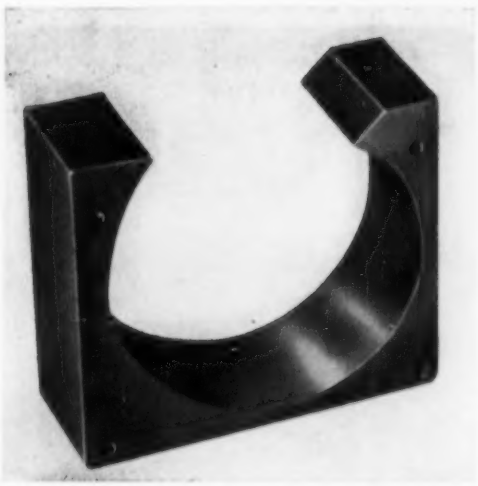
In constant operation for 15 months on emergency parts, the machine is doing an outstanding job. Improvements added later include a standard grid pattern to simplify setup and a hydraulic depth-control rotary stop. Devices such as fluid motors were added to other machines so that accuracies in translation control could be studied for future machines with screw drives. These motors have proved very accurate for dimensional control.

As integral spar caps 30 to 40 ft long were designed, hydraulic cylinder lengths became a major control problem. Ten-foot-long cylinders create restrictions on accuracy. Therefore, an automatic cylinder-clamping device was developed which permits machining long pieces without translation interruption. Now, machines can be 10 ft or 10,000 ft long with negligible loss of accuracy.

For small-lot use, listen to Tom Gibson, staff assistant to the VP in charge of manufacturing at Consolidated Electrodynamics Corp. "We realized we were not using our converted profilers to their full potential. Namely, the description "profiler and tracer" does not limit the equipment to curves, radiuses, and other odd shapes. Actually we had a machine that was capable of out-producing the vertical mills on a very large percentage of our jobs. Sure, there are jobs when a single cut is made, and there are jobs where table motion in two planes, with broad tolerance in the work and very small lots, make tracing impractical, but they are not typical."

"When an operator has to control his dial read-

"SWISS CHEESE" is machined in 70 min on a Morey profiler converted for hydraulic tracing



SMALL CONTOURED PART is typical of broader application of this method. For short runs, spare parts, and prototypes, as well as production quantities of complicated parts, contour-controlled millers show big savings over conventional milling methods

Engineers and production men from Consolidated Electrodynamics Corp, Convair, Douglas, Farnham Mfg Division of Weisner-Rapp Co, North American, and Northrop spoke of their experience with contour controls on machine tools at an all-day conference held by Tru-Trace Corp, El Monte, Calif. Here's a hatful of their ideas

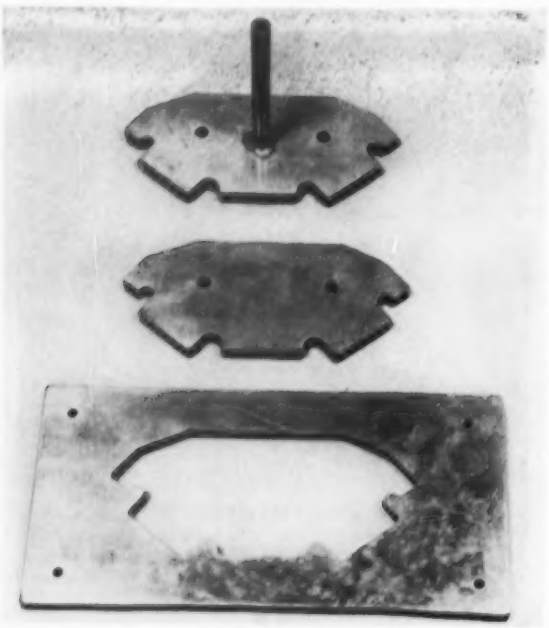
ings, and when he lacks complete confidence in his feed stops, he has a natural tendency to check his work frequently. This costs production time. With tracing we find that the operator, as soon as his templet has been proved, gains confidence in the accuracy he is producing and spends very little checking time after the first-piece inspection. Also, our inspectors develop assurance that the work is uniform. Thus, as a rule, in a multiple-operation set-up, the inspector can check one operation for size and location and know that the other operations will be relative."

"Our company", says Mr Gibson, "has two Model 12-B Pratt & Whitney profilers which have been converted to hydraulic tracing. One of these machines was operated for sometime as purchased; namely, by hand. Thus, we have been in an excellent position to compare costs and quality of both methods of operation based on experience. Both machines are equipped with Portage quick-change chucks, mist cooling, and a turret stop containing a built-in dial indicator for vertical adjustment of the spindle. We generally attach the tracing templet and work-holding fixture to a common plate, which has two locating points that have been established to provide the correct relative positions of the stylus and cutting head—for quick setup."

"Our templets are made from aluminum or magnesium and, because of the very low tracing pressures, they show no measurable wear after considerable use. Every effort is made to complete as many operations as possible in one setup, even though we may have six different cutting levels and 12 to 14 different areas to be machined such as holes, slots, contours, and other surfaces that can be cut with a vertical machine. Many of our templets are stacked three and four high on slip-fit dowel pins. This practice allows machining where overlapping operations occur. Wherever size and shape will permit, carbide cutters are used. The excellence of hydraulic control allows us to use climb cutting 90% of the time. We have never experienced even the slightest pull, even in our heavy cuts. Cutter life has increased as a natural result of controlled operation."

From Convair-San Diego's Plant No. 1 came R W Peters, superintendent of tool engineering, with some ideas on standardization, production experience, and a hint to the contract shops.

"According to an initial survey by our purchasing department, very few outside machine shops could machine the components we require without reworking machines by the addition of tracing attachments to planers, boring mills, lathes, and conven-



BLANKING DIES *are made for 50% less than by conventional methods using a tracer attachment to profile the punch and a matching brass plate which is used on the Elox machine (electrical discharge machining) to cut the opening in the dieblock. The punch and brass electrode were milled in 9 min. Before the die steel is placed in the Elox machine the punch outline is scribed onto the surface and the cavity is rough sawed 1/16 to 0.030 in. undersize. The punch land is ground clear so 3/16 in. is retained when the electrode has completed its cutting cycle*

tional milling machines. One vendor started to profile with some existing equipment and he found it so underpowered that, after his initial production was started, he had to convert a planer to a tracing machine to enable the shop to meet its schedule.

"To show the time factor for some of these parts, it requires 950 hr to machine a fuselage bulkhead from a slab and we anticipate that 500 machine hr will be needed to produce a similar part from a forging. The largest wing spar required 1500 hr of machining to produce a 76 lb part from a 1600 lb billet, 700 machining hr for the 750 lb blocker forging, and 470 hr for the 263 lb finished forging.

"Even with the big-press program, the airframe industry will be hogging parts for their initial airframes on any new program. And most forgings from the presses will require a roughing cut and a finish cut to allow for forging stresses. At present, hogging is done on reworked planers and other kinds of equipment which have been adapted for this task with tracing attachments. Convair feels that an inexpensive hogging machine could be developed which would greatly increase production. The specifications for this machine are in NAS standards, with 50 to 100 hp and reproducibility tolerances of 0.030 in. This machine tool would have tracer-controlled movements of 76 in. traverse and 172 in. longitudinal.

"We have adapted some of our equipment to tracer control and, on some parts, such as those pictured, production has been increased up to 400%. With very low cost and little tooling rework, more than 150 jobs have been converted to the tracer method. In line with cost reduction, the Facilities Section of Industrial Engineering at Convair-San Diego now is purchasing new mills without feedscrews, etc, and is having these machine tools delivered to the tracer manufacturers for installation of this equipment before delivery to Convair."

The question most asked is, "What is the reproducibility of this tracing equipment?" Tom Gibson, Consolidated Electrodynamics, says, "We have held 0.002 in. to the templet dimension without any great difficulty. However, our regular work is roughly 0.003 to 0.005 in. The tracing valve is capable of closer tolerances than this; on a few parts we have held 0.0015 in. max. Nevertheless, the tracer is not a cure-all for poor shop practice."

CAVITY MILL

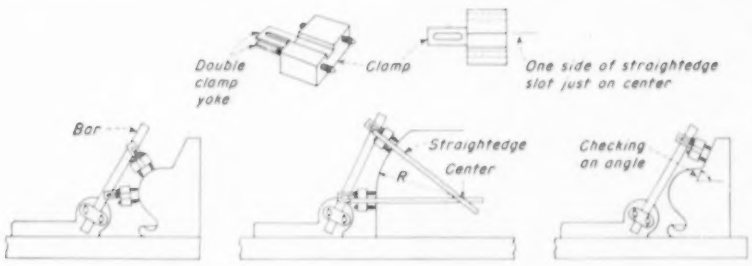
Charles "Chuck" Morlath, Facilities Machine-Tool Engineer at North American Aviation Co provided some industrial engineering views, as well as a description of his company's "cavity mill".

Said Chuck, "The complexity of current aircraft structural components presents numerous problems to the industrial engineer and to the machine-tool builders. To achieve economical production on the conventional machine requires, first, eliminating the responsibility of the operator to control the machine to produce the accuracy on the complex parts. Second, an unskilled operator must be able to operate the machine after a few hours of instruction. Third, facilities engineers must plan for machine automation to reduce set-up costs. Conventional machine tools do not have the versatility or the simplicity of operation to economically produce these complex parts on a production basis. However, machine-tool accessories, such as tracers and profile attachments, can easily overcome this problem."

North American has developed equipment in line with this thinking. Many vertical and horizontal "knee" millers have been equipped with tracer controls. In normal practice, tolerances are held within 0.005 in. To relieve the operator of this responsibility, a setup man positions the templet and the work-holding fixture. He also provides the proper cutters pre-positioned in adapters, with the tracer stylus and an operation sheet for the entire job. An adjustable-feed backarm permits placing the stylus on the right side of the cutter spindle and also, alternately, in front of the spindle. This provides greater machine utilization.

Other innovations include an arrangement for machining both sides of a part simultaneously, thus minimizing distortion, and a multiple-cutter system. Also, on a main-wing panel, automation is achieved with packaged cam templets, rather than tape, using 49 templets ¼-in. thick automatically selected and cycled to complete a job formerly requiring 60 hr in 2½ hr. Material removed weighs 2000 lb.

Practical Ideas . . .



Surface Inspection Device Locates and Measures Circle Centers

When a machine part has a radius on its surface, and that radius must be checked or measured, this equipment will do the trick. It has limited accuracy, but it does a job that is otherwise difficult or impossible.

The base is heavy, and has a swivel to which is attached a 2-in.-wide steel bar about 36 in. long. On the bar are two clamps, each built to support two cone-pointed screws. The clamps will also support spring-steel straightedges by means of slots through the clamp bodies.

When a bulge or convex surface is checked, the two clamps are loosened, the device is moved up to the work, and the clamps are tightened when all four cone points contact the work. It is most important that the screws extend equally from the clamps. One way to check this is to install the straightedges and use a square to make sure the screws on each clamp extend equally.

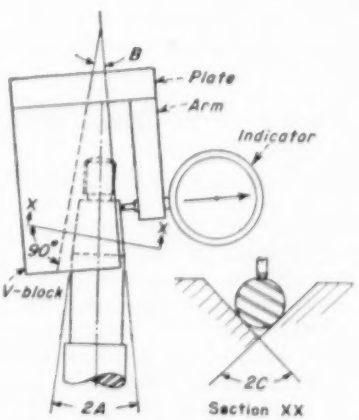
After the points are touching the work, the clamps are tightened, the gage is moved back, the straightedges are installed, and the point where they intersect is measured. The radius is the distance from the intersection back to any of the cone points. The height is measured directly with a surface gage or square.

The gage will also check concave surfaces, if they are not too small; only the intersection of the straightedges will be back of the base. It will also inspect angular surfaces, in which case measuring is done with a protractor.

It is important for accuracy that the slots in the clamps be close fitting around the straightedges, that the screws be fairly close fits in the tapped holes in the clamps, and that the screws are parallel. In addition, the slots for the straightedges should be offset so one edge of the straightedge is centered between the two screws; of course the straightedges and screws must be parallel.

Some of the measuring done by this device can be done with optician's equipment, but not all.

John Dernoga, Rochester, N Y



Indicator and V-Block Check Tapers

Taper ring gages take some skill and experience to handle with accuracy, but this dial-indicator attachment can be used by unskilled operators, once it's set up for the work being checked.

Main problem is the angles. First, there is angle A, the taper angle being inspected. Angle B is the angle the bottom of the V-groove makes with the centerline of the part. Angle C is half the included angle of the V-groove.

It can be worked out with analytical geometry and trigonometry, but it boils down to this:

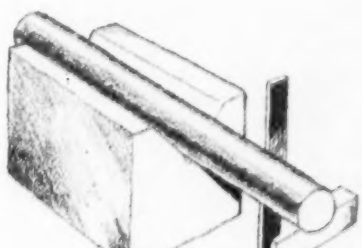
$$B = A + \text{Sin}^{-1}\left(\frac{\text{Sin C}}{\text{Sin A}}\right)$$

And for the simple case where 2C is 90°, the equation is this:

$$B = A + \text{Sin}^{-1}(\sqrt{2}\,\text{Sin A})$$

The gage itself is simple and straightforward, and not hard to make. If the work is large, the attachment should be slipped over its end; if small, the work can be taken to the gage. Once built, the gage is ready to use if you establish the limits allowed on the dial indicator.

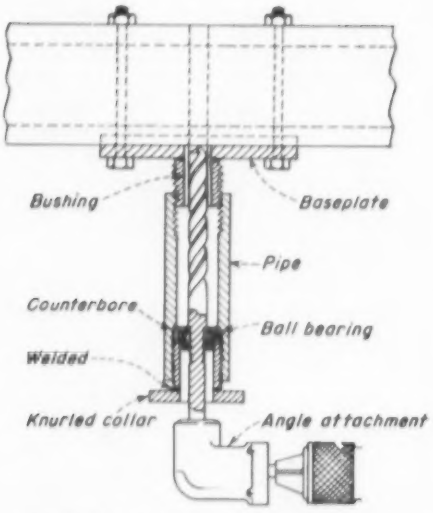
P H Winter, Syracuse, N Y

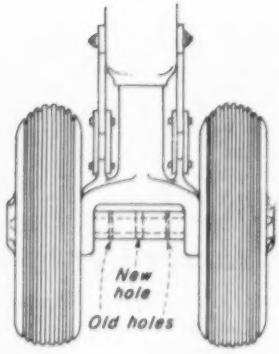


Quick Offhand Centerline Method

A quick way to cut the setup time to scribe a centerline on a shaft, when getting ready to drill a hole in round work, is the V-block and square or square block method shown here. The shaft is held in the V-block. Placed on its side, the square is drawn against a blued area on the shaft with enough pressure to scratch the bluing. By placing the V-block on its side, another line may be scratched at right angles to the first one.

Richard S Fagerman, Chicago, Ill





Jacking Drill Attachment Produces Upside-Down Pressure

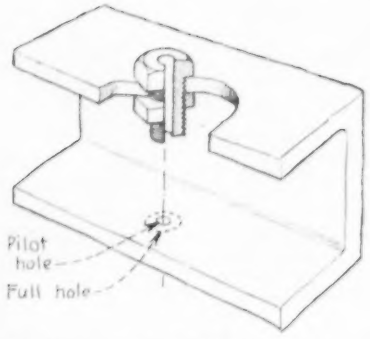
Aircraft landing-gear axles had to be drilled through vertically, but we couldn't move the plane or take off the landing gear. This meant we had to drill vertically through hardened steel right on the field.

Best approach seemed to be with a jacking fixture made from pipe fittings, mainly. There were two existing holes through the axle, one on each side of the new hole. Through these we bolted a heavy baseplate that had been drilled, and to which was welded a pipe nipple.

Inside the nipple we located a drill bushing. Then we added a heavy pipe tapped at both ends for nipples. At the bottom end we inserted a ball bearing attached to the drill we were going to use, and clamped the outer race of the bearing with a nipple and knurled collar. The inner race of the bearing was clamped to the drill shank.

Two men work the jig; one to run the drill and right-angle attachment, the other to jack up the heavy pipe as the drill bites. To get the top wall of the axle, we used a shorter heavy-wall pipe, which extends the drill farther up.

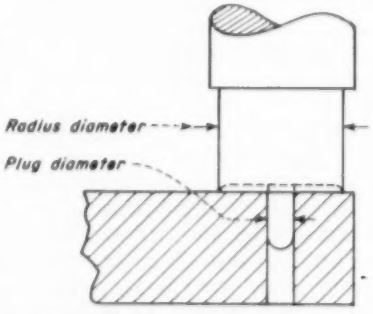
M/Sgt. James R Wood, APO, N Y



Bolt Acts As Drill Pilot

A ¼-in. hole drilled through a ½-in. bolt can ease the problem of drilling concentric holes through parallel frame members: Drill the ½-in. hole through one member and place the bolt in this hole, fastening in place with a nut. Using a long-shank ¼-in. drill, let the bolt act as a pilot for the hole in the other member. Then drill the ½-in. hole from below.

Harvey Muller, Danboro, Penna

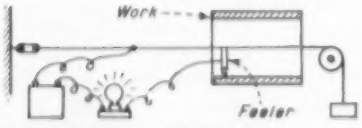


Radius Plug for Layout

You can always scribe a radius on a templet or cam with dividers before the center hole is drilled, but afterward (if there is a hole) it's not so easy. In this case, make a two-dia plug in the lathe around which you can scribe, or which you can simply rotate.

The plug has a center dia to fit the hole existing in the work, and the outer dia is the required radius. If the radius is small, the outer shoulder can be dished, and the plug simply rotated on the work. If the diameter is large, you can scribe around the plug.

Frank La Saracina, New York, N Y



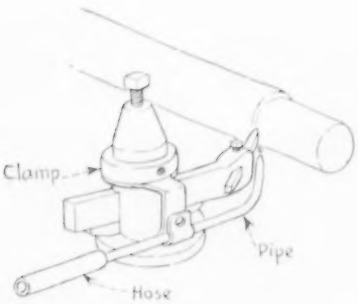
Tight Wire and Lamp Check Work Alignment

If a piece of bored work is to be lined up with its axis exactly on a wire stretched through it, an electrical hookup is more sensitive than feel or experience.

Attach one side of a battery to the wire, the other to the work, and use a feeler between the wire and the ID of the work—it might be an inside micrometer, or just a piece of metal. The battery should be of fairly low voltage, and the lamp should be quite sensitive—that is, when full current flows through the light, it should be bright; and therefore if the feeler just touches the bore and wire, you should get a flash.

An ohmeter can be used in place of the battery and lamp, and would be more sensitive, but one is not always handy in a machine shop.

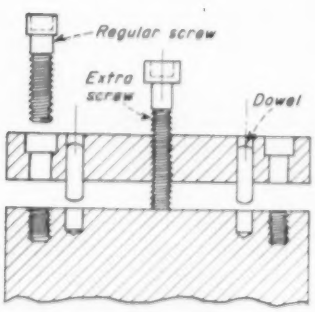
T R Hare, Berkeley, Calif



Pipe On Toolpost Directs Coolant Flow

A copper pipe fastened in the clamp shown here and held on the top of a lathe toolpost is an effective way to direct coolant flow underneath the tool onto the work. This method is more effective than the conventional hose, because, (1) the coolant flows under the chip rather than on top of it, and (2) the pipe and hose move with the tool, rather than having to be readjusted as the tool traverses across the work.

John Dernoga, Rochester, N Y



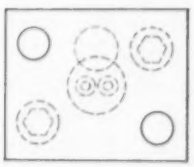
Separating Jig Plates

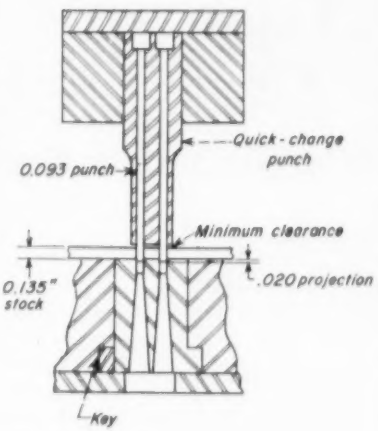
Sometimes when a drill jig is built, the maker forgets that it may be necessary to pull it apart to insert different or new drill bushings. For this reason, it's a good idea to provide an extra threaded hole in the assembly to simplify taking it apart.

As illustrated, the hole should be in the top plate over a solid surface of the jig body underneath. When the main assembly screws are removed, the dowels still hold the jig together. Insert a screw in the extra hole, turn it down to raise the top plate, and go ahead with your corrections and adjustments.

This eliminates the need for hammering on the jig, which may cause damage, and certainly takes more time.

Frank La Saracina, New York, N Y





Quick-Change Punch Holder

The punch holder shown here has proven very satisfactory both to use and to maintain.

A special commercially available quick-change punch is used to support two quills, which are necessarily made short to keep deflection to a minimum. The head and shank of the quill are drawn to prevent breakage.

The two quills are well supported by the quick-change punch, but at the same time the setup allows the toolmaker to make a quick change of the working parts in case one of the punches breaks.

R P McCann, Hancock Manufacturing Co, Jackson, Mich

Old Carbide Tips

A good scriber or scratch-all can be made from a scrap toolbit. Braze the bit to a rod, and grind the bit to a point.

Ed Burroughs, Mosinee, Wis

Winner No. 242

VICTOR STUART
Westfield, NJ

won $25 in addition to regular payment for his idea:

DOUBLE ACTING DIE

in the issue of Dec 19, 1955

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

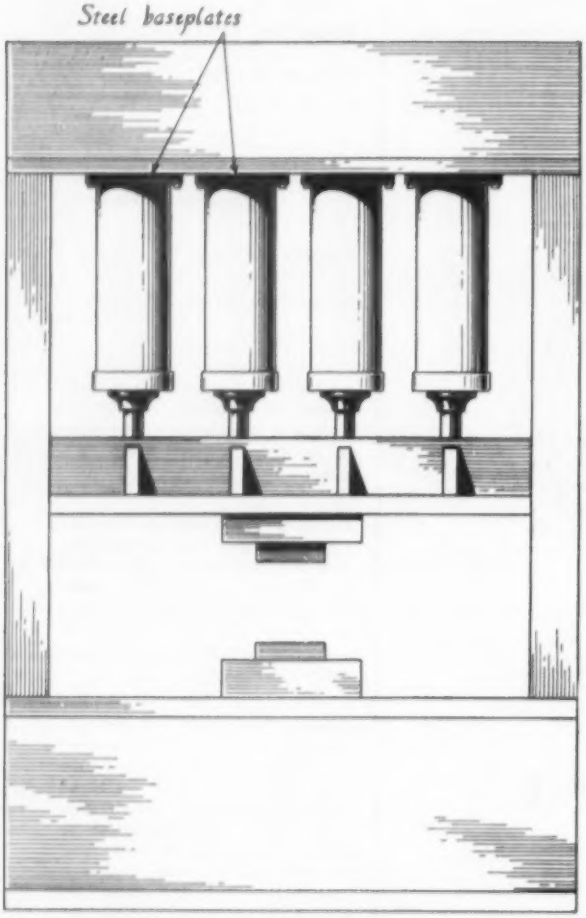
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Four Dump-truck Cylinders Make 80-ton Hydraulic Press

We improvised this hydraulic press from four dump-truck hydraulic cylinders, each with an ID of about 7 in., with ⅜-in. wall thickness. At 1000 psi operating pressure, this gave us a force of about 20 tons per cylinder, or a total working capacity of 80 tons.

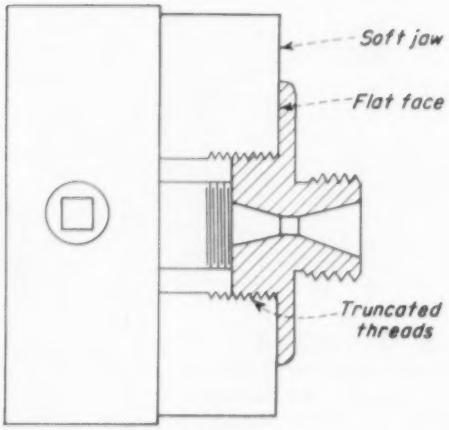
The cylinder was cut near its base, and a steel plate was welded on. Plugs near the top and bottom are air vent plugs. Under the table is the cushion (blank-holder table) which also uses two dump cylinders. Air pressure up to 200 psi has been used, giving a maximum blank pressure of 16,000 lb.

H-beams, I-beam and channels, and hydraulic pumps (two) were also war-surplus materials. We made the 4-way valves, solenoids, relief valve, and the like, and purchased electrical reversing switch, limit switches, and certain other electrical equipment.

Total cost of the press was about $3200 at current rates of exchange, which we thought cheap for an 80-ton hydraulic press with air cushion, electrical accessories, and foundation, installed and running.

One job in the press is the second draw of a corrugated streetlight shade. We have also made a 40-ton press of similar construction, using only 2 of the dump-truck cylinders, with two cushioning cylinders under the table. It does lighter work.

Juan Gotauco, Rizal, PI



Soft Threaded Jaws Grip Second-operation Work

If you use a threaded adapter for holding threaded work on second operations, it is often difficult to remove the work after machining, especially if heavy cutting has jammed the work tighter into the adaptor, or if there are no flats across which you can grip a wrench.

But if soft metal jaws are first bored, then tapped or chased in the lathe, the part can be gripped, yet will be released easily when the jaws are retracted. If at all possible, a flat face should be left on the jaws against which the work can be tightened—this takes up much of the impact.

The jaws should be machined to allow clamping without damaging the threads. Threads on the jaws should not be sharp, but truncated so they don't grip too tightly. Tool force keeps work tight.

W A Peters, Chiswick, England

Rings the Bell

Next reaming job, be sure and try
The stuff they call homogenized Spry
You may laugh now, but not when you see
What a slick job it does; then you'll agree
It's not a bit messy; it's really swell
And it beats white lead all to heck

Richard L Newton
Detroit, Mich

300 H.P. and 60" FEED with Shear Clear Face Mills

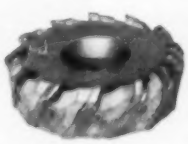
These 14" Ingersoll carbide Shear Clear Face Mills, powered by two motor-driven heads of 150 h.p. each, are shown removing 7/16" of cast iron at feed rates of 60" per minute, more than three times the former rate. This roughing cutter can take up to 1-1/8" of tough metal.

Few Ingersoll customers will require 300 h.p. and the cutting capacity of these specially-designed heavy duty cutters. However, the experience gained through unusual operations such as this is reflected in the constant improvement of Ingersoll's standard line of inserted blade milling cutters.

Many of these design advancements, including the use of new cutting angles, are incorporated into the Ingersoll Shear Clear Face Mill. The patented Ingersoll Shear Clear will out-perform all other types of face mills. Its free cutting, shearing action permits much higher feed rates, gives you smoother finish and longer tool life.

Here are some of the many types of Ingersoll Shear Clear Face Mills. Each Shear Clear has been developed for a particular class of work and has variations in cutting angles and blade materials for different metals. All Shear Clear Cutters offer the economies of inserted blade design, and can be furnished in various sizes with carbide-tipped, cast alloy or high speed steel blades.

For General Purpose Milling



For Aluminum

For Steel

For Light Cuts of Cast Iron

For Heavy Cuts of Cast Iron

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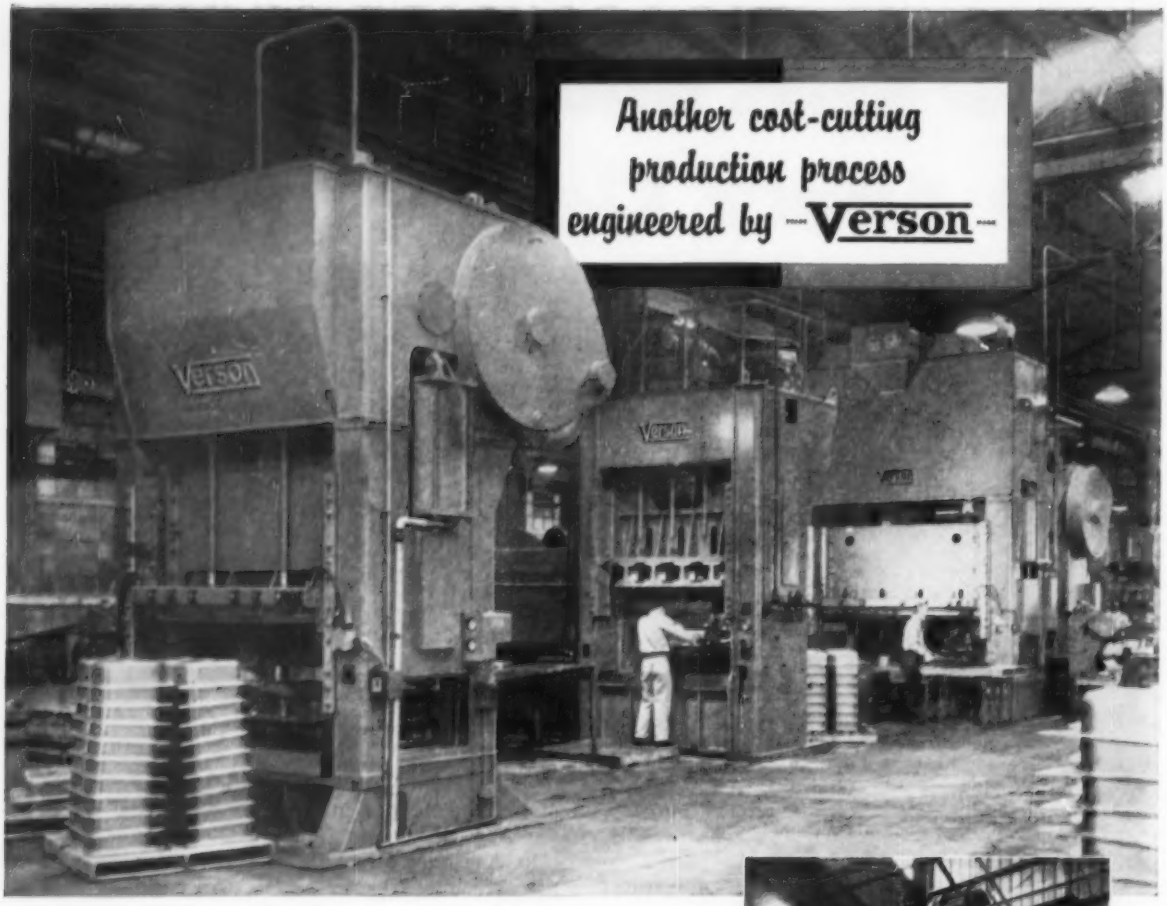
THE INGERSOLL MILLING MACHINE COMPANY

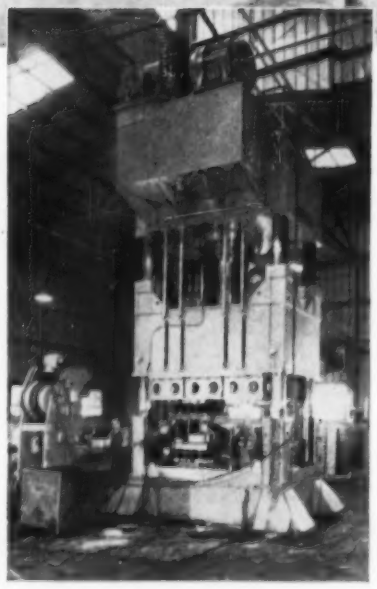
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF SHEAR CLEAR CUTTERS



This —Verson— line-up cuts costs on double sump sinks



• The press line illustrated above, part of the final operations in forming double sump sink units before porcelain enamelling, includes Verson eccentric, hydraulic and crank presses. Previous operations on the sinks include deep drawing the sumps to a depth of 7 3/8" from 14 gauge Armco deep drawing stock on a 1000 ton Verson hydraulic press and piercing and embossing the center drain hole in the sinks on a Verson O.B.I. Both of these presses are shown at the right.

This is more than just a line-up of Verson presses . . . it's a production process engineered by Verson to cut costs as an integrated part of the complete manufacturing program. Verson has the experience and facilities to meet the most exacting press requirements . . . and the "know how" to blend these presses into an efficient and practical production process.

Put Verson facilities to work for you. Send an outline of your production requirements.

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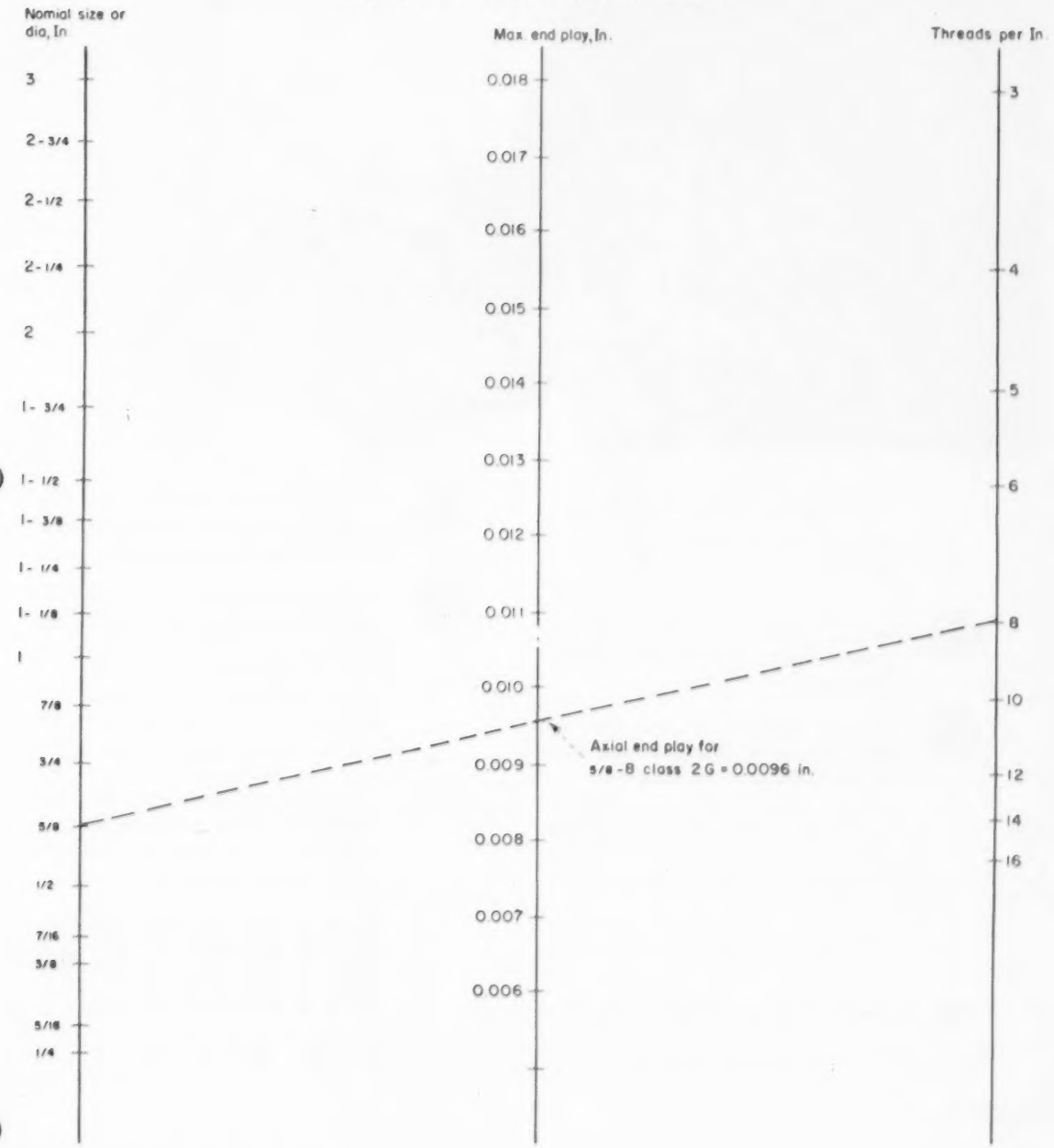
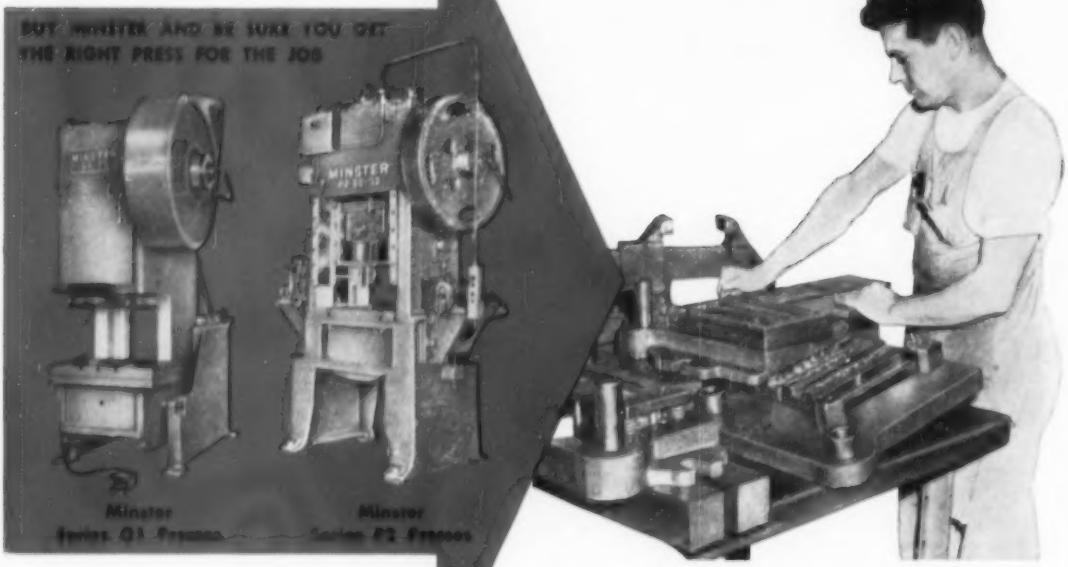
END PLAY OF ACME SCREW THREADS . . . II

MAXIMUM END PLAY FOR CLASS 2 G FIT



A Minster Press means

LESS DIE REPAIR



These Minster Press features *protect* dies from needless expensive repairs.

1. Rugged Minster Frames assure the greatest rigidity with the least possible deflection.

2. Accurate alignment of slide face and bed is assured by Minster Design. Beds scraped to surface plate. Long slide ways scraped square to slide face. Gibs accurately ground and adjusted for proper clearance using ground spacers on all front gibs of presses over 60 tons.

3. Minster bearing bushings honed to proper clearance thus reducing impact shock and snap-thru backlash.

4. Minster patented Combination Air Friction Clutch and Brake has smooth shock absorbing action which tends to reduce die wear caused by impact. Fast controlled engagement or disengagement on 360° surfaces gives opportunity for operator to stop slower presses before dies close in case of misfeed. It also makes possible the use of precision switches in dies to anticipate misfeeds on automatic operations and stop press before serious damage occurs.

Build a sound replacement program modernize with Minster Presses

THE MINSTER MACHINE COMPANY

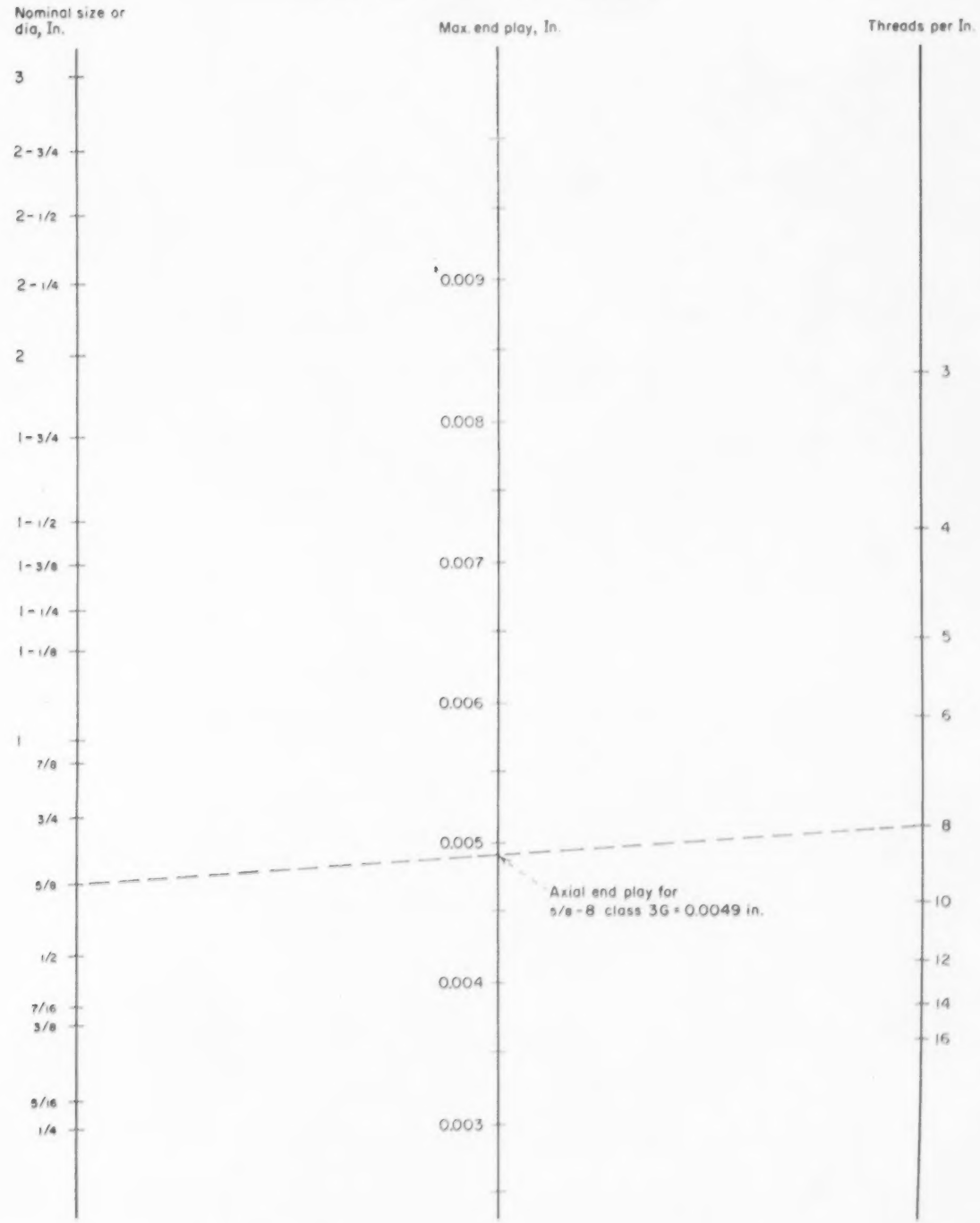
MINSTER, OHIO

MINSTER®

PRESSES

END PLAY OF ACME SCREW THREADS . . . III

MAXIMUM END PLAY FOR CLASS 3G FIT



Here's a story that COUNTS

. . . Tool Life INCREASED 33⅓% by using COPPERWELD 8620 LEADED ALLOY STEEL

A manufacturer of hydraulic pumps was averaging 7200 pieces per set of tools used in milling slots on this hydraulic pump rotor. By switching to Copperweld Leaded Steel, this tool life was increased to 9600 pieces.

In addition to longer tool life, leaded steel gives faster feeds and speeds, and a finer finish often eliminates a clean-up operation—truly, the steel with "built-in productivity." To put more operating profit in your production picture, try Copperweld Leaded Steels.

ARISTOLOY STEELS

Write for free booklet, "Lead Treated Steels."

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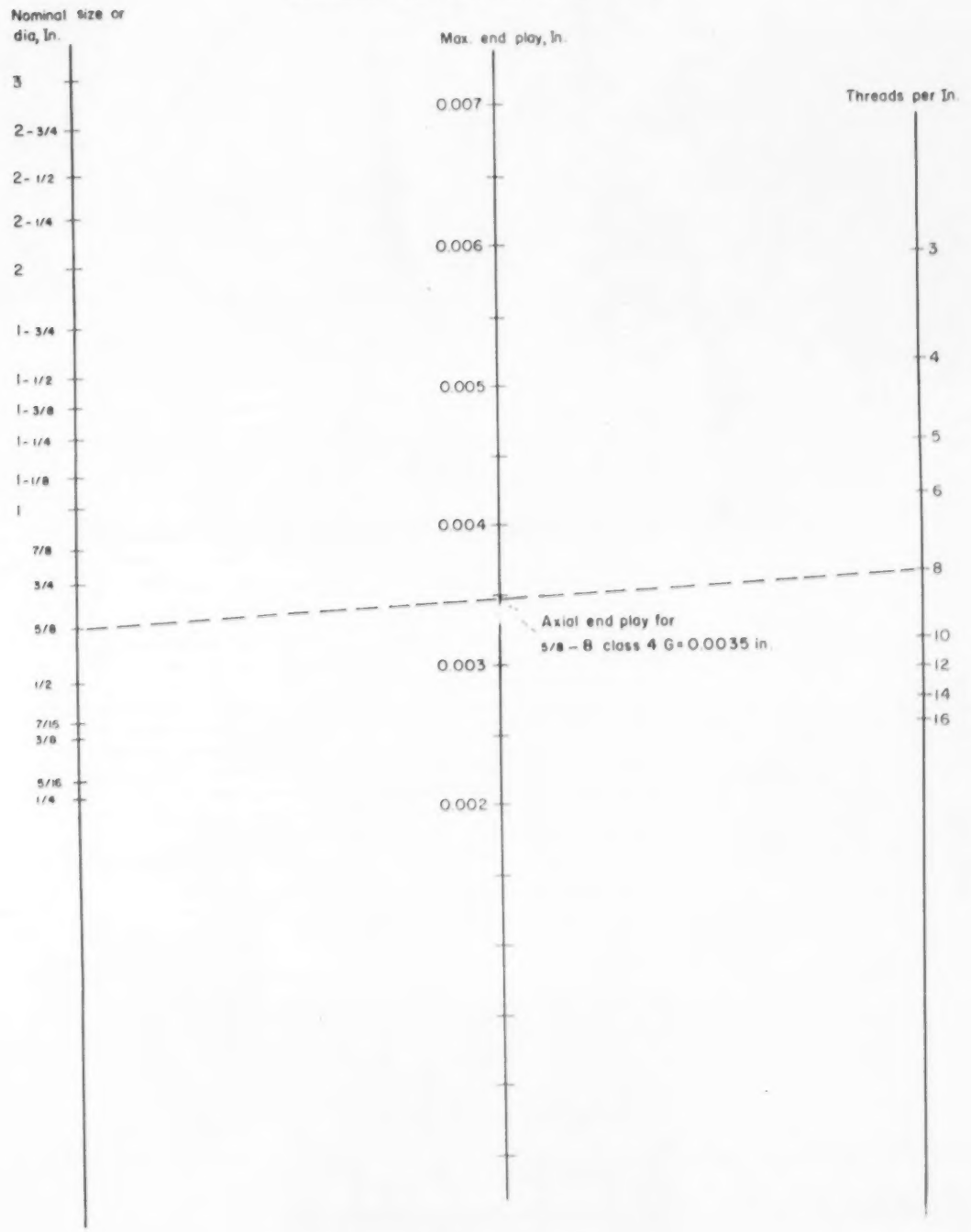
EXPORT: Copperweld Steel International Co., 117 Liberty St., New York 6, N. Y.

END PLAY OF ACME SCREW THREADS . . . IV

MAXIMUM END PLAY FOR CLASS 4G FIT



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He represents 44 years of experience and service in making quality hobs for gear manufacturers.

Because precision gear making is an extremely demanding process, your Illinois Tool Works sales engineer is just the man to see. He knows hobs and hob requirements. Backed by nearly half a century of experience and engineering skill in the production of precision hobs, he can help make your gear generating operations more efficient, less costly. Have him show you the exclusive TOOLGRAPH® chart that accompanies every ground and Certified Unground Illinois Tool Works Hob. It's a visual, electrically produced inspection record that provides positive proof of hob accuracy. Why not talk to the Illinois Tool Works man about your hob requirements?

Write Today! Send for this important data-packed booklet that can help you produce precision gears at lower cost. Ask for the "Certified Unground Hob" booklet.

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Look to your Illinite Distributor for the most complete line of standard end mills, standard milling cutters and special cutters.

Talking Shop . . .

Penetrating Soda

CHARLES KIRBY of Burlington, Vt, who builds boats in the shop adjoining his home, has a tip on loosening rusted bolts or metal caps that can't be budged. "Just get a bottle of Coke," says Charlie, "and pour a little on. They'll move."

Cigarette Arbors

WHEN CIGARETTES are packaged, the wrapper is formed and closed at one end over a thin steel arbor. The 20 cigarettes are compressed and pushed into the arbor, which is then withdrawn from the package. For years, Brown & Williamson has made arbors of cold-drawn steel that had to be coated with lanolin when not in use. (Any rough spot or corrosion inside the arbor might damage the cigarettes.) A recent change to Type 304 stainless not only eliminated rust in storage, but also avoids trouble with corrosion where the arbor is soldered to the brass base that mounts it to the machine. Babcock & Wilcox is supplying rectangular tubing of the proper size to tolerances of ± 0.003 in. Tubing is simply cut to length, spread at one end to fit in the arbor base, then blast cleaned.

Vacuum Brazing

EXPERIMENTS with vacuum brazing at Pratt & Whitney Aircraft have shown that copper brazing of stainless steel to nickel-base alloy gives better ductility than brazing in air. Shear strength is about the same whether brazed in vacuum, hydrogen, or dissociated ammonia. A special Stokes furnace designed for large-scale production has a double wall with resistance-heating elements between the walls. Thus work is not exposed to the gasses emitted from the heating elements. The inner chamber can be evacuated to a pressure of 0.05 microns and heated to 2150 F. Cycle is about a day and a half.

Plain Bearing

SINCE Bannister ran the 4-min mile, speed records seem to have been falling with monotonous regularity. New records for airplanes are more or less expected, but it has been a long time since anyone made an assault on the railroad record. The break came two years ago when a French electric locomotive pushed the high mark to 150 mph. And shortly afterward, two other French locos made a huge jump by making the run from Lamorthe to Morceux at a speed of 205.7 mph. It is worth noting that all the engines were equipped with plain tin-lead bearings and mechanical lubrication. The oil film in the bearings is only 4 to 5 microns thick, so axles have to be lapped to a fine finish. Bearings are made about 0.15 in. larger than the axle diameter, then a central sector about 1.5 in. wide is scraped to make full contact.

Tough Tile

TUBULAR DRILLS to cut holes in acoustical tile are being flame plated with a 0.002 in. surface of tungsten carbide. This has increased production from 4000 to 200,000 holes per drill, according to Linde Air.

Hot Box Study

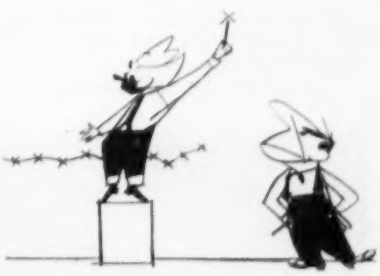
ARMOUR RESEARCH FOUNDATION, in recent studies, found that the ideal bearing clearance for a railroad journal is about 0.004 to 0.006 in. Too much is as bad as too little. But manufacturing and operating tolerances would have to be 0.0005 in. to make this possible. As a compromise, it was found possible to have a bearing contact surface at the top of the journal only 2 in. wide, and clearance could be 0.015 to 0.020 in. Too much clearance (viz the present allowed 0.377 in.) allowed a hotbox.

Plastic Pipe for Plating

PERFECT CIRCLE is using unplasticized polyvinyl chloride (PVC) piping in a new chromic-acid recovery system. Elimination of metal scale in the system was found to protect plating solutions from discoloration and contamination. Leaks caused by corrosion are avoided and life is expected to exceed metal pipe. The PVC pipe doesn't have to be painted.

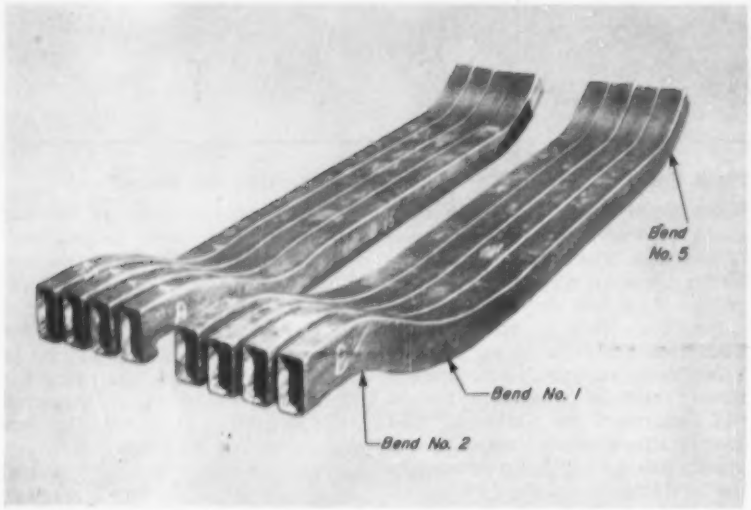
Automation for Hens?

"WE'RE JUST BEGINNING to hit our stride in poultry-house automation," said a national authority on poultry housing at Pennsylvania State University recently, proving again that there is no limit to the uses of this new word. Placing the poultry house in an east-west position, with the south wall constructed of insulated glass, it has been discovered, assists the winter sun to remove moisture, solving the wet-litter problem, and reducing the danger that a careless, un-oriented production worker will produce dirty eggs. Multiple roosts over a pit with automatic feeders and waterers at four or five levels, makes it possible to cram more birds in less space, thus giving greater efficiency to the mechanical devices. While we concede that the provision of dry litter and a constant supply of food and water make more comfortable working conditions for the hens, thus providing a superficial resemblance to automation, we can only protest at this further abuse of a good word. Promotion of the frying pan and the stove may be automated, but egg production is neither *continuous* nor *automatic*.

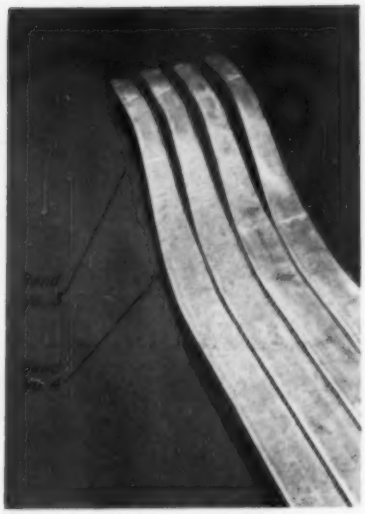


Production Score

MACHINE OPERATORS keep a graphic record of hourly production at the John Bean Div of Food Machinery & Chemical Corp. On a chart posted by the machine, the operator makes an X to show the number of parts produced during each hour, connects the X's to form a graph. The chart shows the standard rate, is used by both the day and night shifts. In addition to pointing out lost production, so corrective action can be taken, the charts establish a competitive spirit between the shifts and are reported to improve morale by showing where the worker stands.



MAIN SIDERAIL SECTIONS of 1956 Chevrolet chassis are 102-in. rectangular tubes requiring five bends. Three of the bends (indicated above) are formed with tube positioned horizontally. Complete siderail is welded of three sections



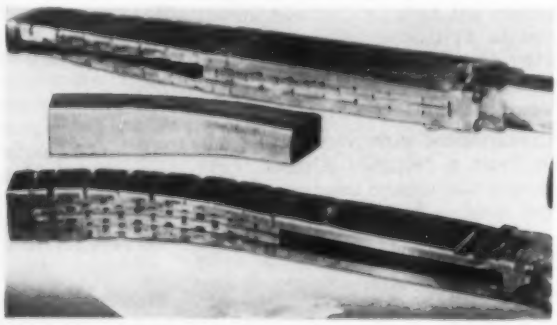
TWO BENDS shown here are made to left or right (depends on side of frame involved) with tube vertical

Cold Bend Steel Tube with Articulated Mandrels

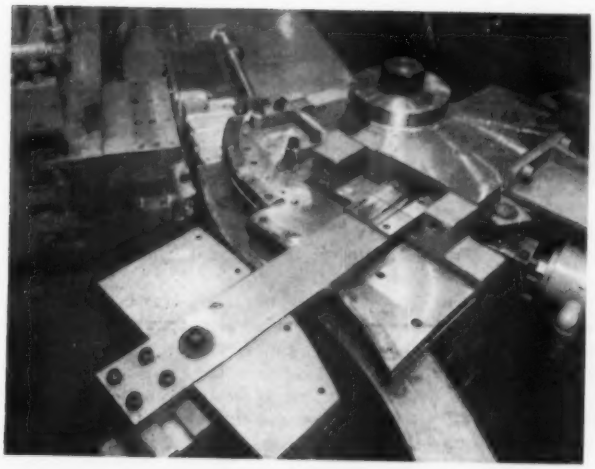
FLINT, MICH—Rectangular welded steel tubing is bent to form chassis frames at Chevrolet's new Bristol Road Plant. (*AM*—Feb 27 '56, p176). Key to the successful application of cold bending to the forming of the long frame sections is the use of articulated steel mandrels. A short center section is produced in mechanical presses, then sections are butt welded end-to-end to form the frame side members.

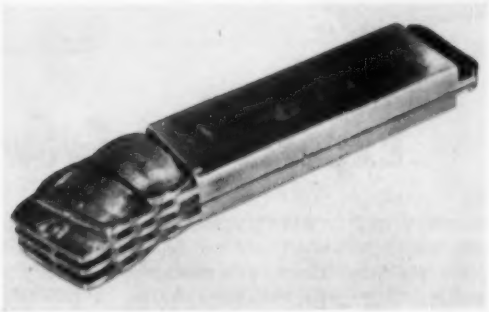
Shown here are the mandrels and tooling developed by Pines Engineering Co for the five bends in the main siderail sections. These mandrels consist of hardened steel blocks shaped to follow the bend as it is made. The blocks are held together with pins that permit the needed flexing of the assembly. Some of the mandrels must be expanded against the tapered walls of the tube after they have been inserted.

Tubes made from sheet stock in an automatic tube mill are delivered to the bender lines by horizontal chain conveyors. Within each line, the tubes are moved from bender to bender by sliding them along steel-topped benches. Five benders are required in each line for main sections, two for rear sections. Formed sections are trimmed in mechanical presses at the end of each line, inspected, then sent by overhead conveyor to assembly.

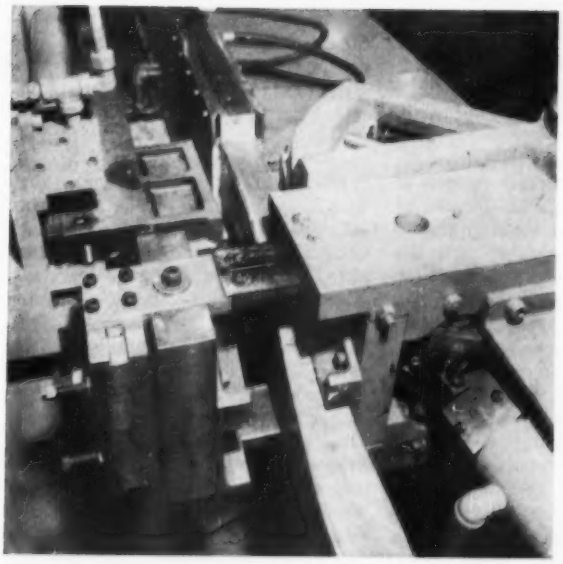


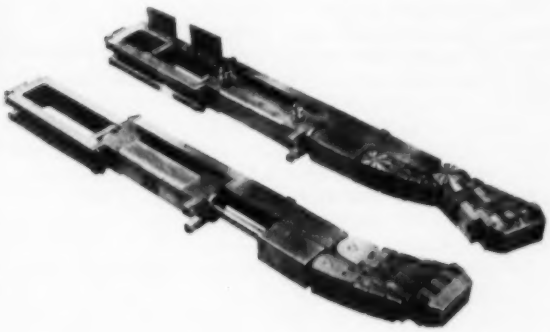
1 . . FIRST BEND is 28½° on 26-in. inside radius near one end of main siderail. Mandrel is collapsed for insertion in tube, then expanded by pushing in articulated center section with hydraulic cylinder so the flexible end of mandrel will fill the tapered tube at bend. All mandrels are lubricated frequently with heavy drawing compound



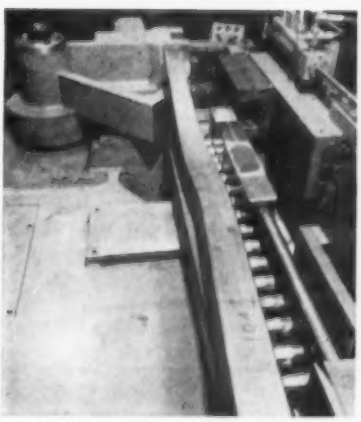


2 . . TOOLING FOR SECOND BEND completely encloses tube around the first bend to provide a smooth, distortion-free bend. Articulated mandrel (which does not have to be expandable) has 14 hardened tool-steel formed blocks held together with pins so they can follow tube form as it is bent

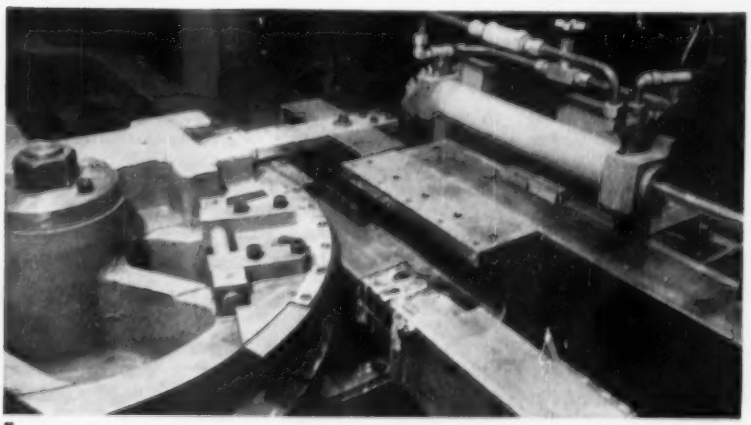




3 . . SIDERAIL IS BENT SIDEWAYS at right angles to second bend. Clamping die holds tube on first bend surfaces. When closed, this die completely encloses the tube. Mandrel, built to flex in two directions, is shown with expander moved forward and retracted. Pushbutton station controls the hydraulic cylinder that actuates the mandrel



4 . . SHORT ARTICULATED SECTION is required on mandrel for fourth bend. It is shown extended to bending position over rollers on which tube is moved to position for bend. Clamping die is lined with hardened tool-steel plates to minimize wear



5 . . FINAL BEND is at other end of tube from the first four bends. A short articulated mandrel on the end of a long hydraulic piston is required. Square shank of mandrel is held in steel guide. Bending and clamping dies lined with wear plates completely enclose the tube

Exports and Growing Domestic Demand Boom

BONN, WEST GERMANY (McGraw-Hill World News)—These are boom times for West Germany's machine tool industry—with 1955 sales chalking up a record $312.5 million, and with builders booked solid for the next 10-12 months. Value of orders placed in 1955 is reliably estimated at around $470 million. For three years until 1955, West German machine tool sales remained steady at $235 million a year.

What are the reasons for 1955-56's sharp jump in sales and output? For one thing, 1955 exports of machine tools totaled more than $135 million of the $312.5 million output —mostly to Germany's West European neighbors, with France and Italy topping the list (see table on opposite page). The United States, contrary to the general impression in this country, is a comparatively minor importer of German machine tools, ranking 12th in purchases.

Then there is a general rise of anywhere from 5 to 10% in prices of German machine tools in the last year or so. Some machines have increased pricewise as much as 48%. Subcontracting within the German machine tool industry increased tremendously in 1955, another factor responsible for the turnover.

Export data on a country-by-country basis are not yet available for the entire year of 1955 but records for the first six months (see table on this page) make it obvious that the West German machine tool industry is fast making up for the export slump that set in immediately after the hectic years of the Korea boom, when US and UK firms deluged German builders with work. During Korea, several German firms concentrated entirely on filling US orders. When hostilities ceased, these firms found the going extremely rough until they could recapture a share of peacetime business.

As is shown on the table of exports country-by-country, Germany's traditional machine tool export balance is still operative: 75% of all exports go to other European nations, the rest overseas. Not even the loss of German's longtime markets in Soviet Russia and her Balkan satellites has done anything to upset this balance.

The United States is not considered a major machine tool market by West Germany, nor is it much of a potential market. Before Korea, both nations thought themselves self-sufficient and independent of each other. Then the Korean War's demands changed the picture drastically and quickly, with German tools in strong demand by the United States and Great Britain. Since then, sales to the US have just about returned to normal.

Korea Helped Germany

But German officials feel that the Korea-caused introduction of German machine tools to the American market has been beneficial to them and that there is a certain residue of good-will which will keep sales to the US from completely slipping to their pre-Korea position. At the moment, sales to the US account for roughly five percent of total German machine tool exports. In 1954, sales to the US amounted to about $6.75 million; total German machine tool exports that year stood at $127.6 million. The Germans feel that the 5% ratio is here to stay and do not anticipate either a drop or a rise in sales to the US.

Biggest German export item to the US is hydraulic presses, German officials state.

United States customs duties and high freight rates are blamed by the Germans for impeding a greater volume of trade between the two nations. German officials claim that US import duties are more than twice as high as German import duties on machine tools.

Thus, as long as European nations present themselves as convenient, accessible markets, the US will not be considered a promising sales outlet at the present time or the foreseeable future.

There has been some increase in the construction of transfer machines in West Germany, but the domestic market for this type of machine is limited primarily to the automotive industry. On the other hand, the Germans are going in strongly for the construction of special purpose machines. It is reported that the construction of standard machine tools is regressing. At a recent fair, several buyers (especially from underdeveloped nations) have stated they were "sorry they could not see simple, standard machine tools on display."

German-built transfer machines find a ready export market; industry officials are quick to point out, however, that this market does not include the United States. Most of the transfer machines built in West Germany go to the highly industrialized nations of Europe, while the underdevolped nations of Asia and Africa have apparently not yet started to purchase transfer machines. At the same time, builders say that "the export of special purpose machine tools is our daily bread."

The trend generally seems to be to include as many automatic devices in a machine tool as possible, cut down on "human action" to the highest possible degree, and simplify designs at the same time. Carbide tooling is generally on the increase in Germany today, especially in turning work where the work process is continuous. In other processes, the Germans are still quite cautious regarding use of carbide tools.

At present there is extremely little

WEST GERMAN MACHINE TOOL EXPORTS 1950-1955

(Value in US dollars)

Year	Tonnage exported	Value in US dollars
1950	29,000	$33,370,000
1951	55,000	70,500,000
1952	88,000	138,180,000
1953	79,000	134,185,000
1954	78,000	127,605,000
1955	82,000	135,595,000

West German Machine Tool Output

EXPORTS BY COUNTRY
FIRST HALF 1955
(in U S dollar value)

France	$8,037,000
Italy	6,227,500
Great Britain	5,546,000
Netherlands	4,347,500
Switzerland	4,230,000
Sweden	3,936,500
India	2,702,500
Austria	2,632,000
Argentina	2,561,500
Belgium and Luxembourg	2,561,500
Japan	2,548,000
USA	2,021,000
Canada	822,500
Mexico	352,500

trade with Soviet Russia and the Communist satellites. The Germans are complying strictly with the general embargo lists. At the same time, it is true that the Russians are now approaching German machine tool makers and are asking for "offers." Since the Russians, however, ask for highly specialized machine tools, which are automatically on the embargo lists, they are turned down cold in 99.9% of all cases. Thus, trade with the East would only become possible if the embargo were to be lifted.

While the Germans comply with the present embargo on shipments to the East, this does not mean that they agree with its underlying philosophy.

"The Western embargo," says one official, "literally forces Russia and its satellites to develop their own machine tool industry. We are forcing them, so to speak, into catching up with the Western world in design and production.

"That they are progressing in this direction, cannot be denied. East Germany, Hungary, Czechoslovakia, even Red China, are now building very decent, standard machine tools."

Another aspect of Russian developments, which bothers the Germans considerably, is the steady increase in Russian engineering talent, as compared with engineering shortages in West Germany.

The German Association of Engineers recently found that West German industry today is shy 40,000 trained engineers. To maintain present standards of technology in West Germany, the Association stated, at least 6600 new engineers are needed every year. This contrasts poorly with the fact that German schools only graduate 2200 engineers annually. The Germans point out that two years ago 50,000 Russian engineers passed their final examinations. And Russia is steadily increasing the number of youngsters going into the engineering sciences.

West German rearmament has not as yet affected the industry. No outright defense orders have been placed with the industry up to this point; and as far as can be ascertained now, there is no prospect for orders in the immediate future. The delay in defense work is apparently caused by a lag in determining what other NATO nations are to furnish to West Germany and what Germany is cheduled to produce herself.

WW II All Over Again?

Industry officials are afraid that the World War II story will repeat itself. "People planning for defense only think in terms of armament. No one in Bonn seems to realize that it takes machine tools to produce these items," one industry source says. "It will probably be the old story again of sudden demand for machine tools which the industry can not fill because of prior commitments. There seems to be no advance planning in Bonn whatever."

Only two combines exist in the industry today; both of them are revivals of combines that existed before World War II — VDF and WEBO. VDF consists of three lathe manufacturers in Hamburg, Hanover and Goeppingen. WEBO is made up of three drilling and boring machine tool builders. No new combines have been added since the war and none is in prospect. One reason seems to be that the "little fellows" are reportedly doing very well by themselves, thus there is no pressure on them to join the big firms.

West German domestic market for machine tools continues to be good. The rise in total sales is primarily because of domestic consumption—export sales have remained relatively steady. Although many firms have, since the war, been forced to start from scratch, there is still an ample reservoir of demand. Overall rise in German production and productivity, trends toward automation, and continuing increase in industrialization, all combine to assure domestic orders for some time to come.

In the export field, German machine tool makers are pretty much on their own. The government does not supply the industry with long-term credits, nor does it take the financial responsibility for foreign sales. Manufacturers and exporters can insure themselves against losses in the foreign sales field, but this insurance is issued by private and semi-private companies.

The supply of young, trained engineers continues to be the greatest single headache for the German industry. Customers now ask for far more engineering to be done on individual orders than before World War II. Before the war, industry members state, a customer supplied you with complete blue-prints and all the builder had to do was to follow orders.

"Today, a customer will invent, say, a new type of paper clip. Then he asks us to design and build a machine tool that will produce that paper clip quickly and cheaply."

The price factor does not seem to affect production and sales of the industry today. Producers' prices have risen steadily: With 1938=100, the index for cutting machine tools has risen to 159 by 1950 and stands at 217 as of December 1955. Non-cutting machine tools rose from 174 in 1950 to 262 by 1955's end.

German builders state that they are not worried about competition price-wise from British, French, Italian or any other manufacturers.

"Today delivery terms decide who gets the business—not prices," says one official. The average wait for a German machine tool today is around twelve months. While the spread across the entire industry ranges from "immediately" to 24 months, two-thirds of all German machine tool builders ask delivery terms of from 4 to 15 months.

Capital Spending Reaches for New Peaks

WASHINGTON — The administration's plans for continued economic growth got a strong vote of confidence from widely separated points in the business process — from top executives who chart long plant expansion programs — and from consumers who buy the finished products.

● Business plans for investment in new plant and equipment, as revealed by a Security & Exchange Commission and Commerce Department survey, point toward a rise three times greater than last year's. Last year, investment was up some $1.9 billion over 1954. Present intentions by businessmen involve a rise of $6.2 billion this year over 1955.

The boom in spending by industry for new plant and equipment, which began a year ago, is obviously gathering new steam.

Equally impressive as the size of the planned jump is the way all classes of industry share in it. Durable goods and railroads are in the van, but even the laggards—transportation industries other than railroads and the catch-all "commercial and other" category—foresee rises of 11% and 12% respectively.

Within the durables industries group, the biggest jump is in motor vehicles and equipment (Note: autos are in this class not in the "Transportation other than rail" class), which spent $1.1 billion last year for new plant and equipment and plans to spend $1.9 billion this year. Iron and steel will go from $863 million last year, to $1.3 billion if present plans are borne out. Primary nonferrous metals industries will practically double last year's $214 million. Electrical machinery and equipment companies expect to climb from $436 million to $579 million; non-electric machinery makers from $809 million to $1 billion.

Chemicals and allied products lead the nondurables parade: last year's outlays of $1 billion are expected to rise to $1.4 billion. Another solid gain is planned by petroleum and coal industries—from $2.8 billion, to $3.3 billion.

● Consumers surveyed for the Federal Reserve Board reportedly are cheerful about their income prospects in 1956, and plan to buy such key items as houses and autos at a rate equal to 1955. If borne out, this means those two industries have under-rated their markets for the year.

Don't Underestimate the Buyer!

Results of the survey, taken by the Survey Research Center of the University of Michigan, added up to a clear indication that businessmen may have underrated the consumer as a factor in the 1956 picture, particularly as to autos and housing. There's nothing in the survey findings to signal a decline in either of these key areas.

Consumer intentions can change, rapidly of course. The survey is taken before consumers can tell about prices for the year as a whole, or the availability of credit.

Optimism about the general business picture is running high, and undoubtedly colors buying plans. Nearly two thirds of those interviewed expect business conditions during the year to be good, the greatest number in the history of the surveys. Consumers in most occupational groups and income brackets share this cheerful view, with self-employed businessmen the happiest of all. Three-fourths of them expect times to be good this year. Farmers are the most pessimistic, but a substantial minority expect a prosperous year.

One of the surprises is the number of consumers planning house purchases, which runs slightly ahead of intentions this time last year. But survey analysts noted that the average income of prospective house purchasers is somewhat lower than last year, so some of these plans may run into difficulty. About the same number of consumers plan household improvement expenditures this year as last, but they plan to spend more per job. The median expenditure planned last year was $330; this year it is $380.

The number of consumers planning furniture and household appliance purchases is about the same as last year and the amount of the planned expenditures is running the same as last year. But the number planning on using installment credit is somewhat lower. Prospective auto purchasers, however, plan on using more installment credit than a year ago.

The two surveys add up to cheerful news for the administration. Nothing could please it more than to go into the November election with business on the rise. Officials feel the trends revealed by investors and consumers are a vindication of their policy of stimulating expansion through liberalization of the tax laws. Charges of unduly favoring business—they feel—can best be answered by pointing to rising employment and rising standards of living. At this point, it looks as though they'd have powerful talking points, come Election Day.

CAPITAL GOODS SPENDING 1955-56

(in millions of dollars)

	1955	Annual rate 1st Quarter 1956	2nd Quarter 1956	1956 (est.)	% gain 1956 over 1955
Manufacturing	11.4	13.7	15.4	15.0	31%
Durable goods	5.4	6.8	8.1	7.7	41%
Non-durable goods	6.0	6.9	7.4	7.4	22%
Mining	1.0	1.1	1.2	1.1	19%
Railroad	0.9	1.2	1.3	1.3	42%
Other transportation	1.6	1.7	1.7	1.8	11%
Public Utilities	4.3	4.8	5.0	5.0	16%
Commercial, etc, including communication, construction, finance, and service	9.5	10.7	10.7	10.6	12%

Buick Makes Sweeping Changes In Manufacturing Management

FLINT, MICH—Jesse L Powers, for five years assistant general manufacturing manager, has been named general manufacturing manager in sweeping management changes announced by Buick. He succeeds Edward T Ragsdale, recently named general manager of the division. Others promoted are: Donald F Taylor, general superintendent, to assistant general manufacturing manager, and Joseph J Schweinfurt, general superintendent, to general superintendent of all Buick plants.

Field Report USA:

West...

Scanning the West . . .

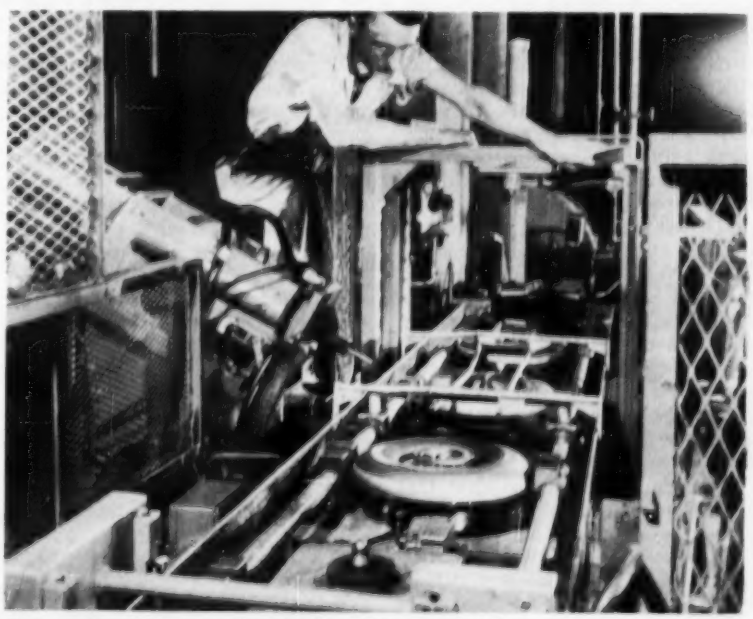
Ford's Mercury Division broke ground March 23 for a multi-million-dollar assembly plant at Rosemead, Calif. The new 1.3-million-sq-ft facility will be Ford's third Los Angeles area assembly plant, will employ 3100 . . . **Lockheed Aircraft** in 1955 faced this paradox: sales and net income dropped off from 1954 but backlog jumped $28 million to $1.2 billion . . . **Marquardt Aircraft** will spend $6 million to modernize and expand its research and development facilities at Van Nuys, Calif—$4.5 million of it to increase the capability of its ramjet engine test facility . . . **Beckman Instruments** has broken ground on a new $2 million plant for its **Helipot Division** at Newport Beach, Calif. **Beckman's Arga Division** has purchased the entire inventory of mechanical and electromechanical components manufactured by **Bolock Instrument Corp,** New York . . . **Plomb Tool Co,** Los Angeles, has acquired **Consolidated Tool Co** of that city, will merge its output with that of another subsidiary, **Industrial Tools Mfg Corp**... If **Norris-Thermador Corp,** Los Angeles, can iron out wrinkles in the Houdry catalytic muffler, it'll go into the auto muffler business . . . **Zenith Radio Corp,** Chicago, will establish a research laboratory at Redwood City, Calif, near Palo Alto . . . **Modglin Co Inc,** Los Angeles, is adding a 50,000-sq-ft welding department to its Metals Working Division . . . **Barber-Webb Co,** Los Angeles, has just finished a $100,000 addition to its Vernon, Calif, plant, including a 4000-gallon dipping tank and an overhead crane system . . . **North American Aviation's** Fresno, Calif, plant has a $7 million Air Force contract to produce modifying kits for F86D Sabrejets . . . **Solar Aircraft Co,** San Diego, has doubled its backlog since the start of its fiscal year last May 1. Unfilled orders at January's end totaled $72 million, are still increasing . . . **Rheem Mfg Co's** San Pablo, Calif, plant will start production of $5 million worth of 155mm shells for Army Ordnance May 1, and will hire 200 more workers . . . **Hiller Helicopters** has been awarded a $3.5 million Defense Dept order to produce Army H-23C helicopters . . . **Boeing** increased its backlog in 1955 by $500 million to $2.6 billion . . . **Donner Scientific Co,** Berkeley, Calif, will build a $250,000 plant at Concord, Calif, allowing the company to handle its own production, now farmed out . . . **Continental Can Co** has bought a 40-acre tract in San Leandro, Calif, will build a plant there in 1957 . . . New metalworking business prospects rose in the San Francisco Bay area when the **AEC** announced it would add ordnance engineering . . . **Boeing** plans to spend $42.5 million on expansion in the next three years at its Seattle and Renton, Wash, plants.

East...

Eastern briefs . . .

Associated Industries of Massachusetts reports that output of electrical machinery jumped 11.8% in January over December, 46% ahead of a year ago. Machinery (except electrical) chalked up a 6.5% gain during the month, running 44.3% ahead of January 1955 . . . **MIT's Metal Processing Division** will hold a two week summer program on "Wear Theory in Metal Cutting and Bearing Design," June 18-29. Agenda will include lectures and lab exercises on these subjects: structure and properties of solids and lubricants, techniques for use in wear studies, radioactive tracer methods, friction and wear in bearings, temperatures and wear characteristics of cutting tools and grinding wheels, and machinability and machining economics. Those interested can get details by writing Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Mass . . . **Worthington Corp** has acquired **Mason-Neilan Regulator Co,** Boston maker of control valves and regulators, will operate it as a division . . . **Glenn L Martin Co,** Baltimore, has been awarded a $28.5-million Air Force contract to supply spare parts, special tooling and technical data for bombers. The company has also been authorized by the Air Force to set

(Continued on page 145)



Computer Controls Hydra-Matic Balance

UNBALANCE IN TORUS HALVES (like a grapefruit but of steel and a foot in diameter) is located and corrected automatically in this new balancer of Detroit Transmission Div, GM. Units are spun at 600 rpm, in the second station (first is loading), while the computer determines angle and amount of unbalance. Information is passed to the welder station (3), where a slug is cut from a strip within 0.001 in. and welded to the inside rim of the torus at the right spot. At station 4, the machine checks itself. If unbalance is over ¼ oz-in., the torus goes to reject; otherwise it is stamped "accept." Transfer between stations and all operations are automatic

A HALF SHELL IS STRIPPED from a pattern in an automatic machine. Cope and drag are each made in its own machine. Sand and phenolic resin, delivered automatically, are invested on preheated patterns and cured at 1200 F

MILLING FOR LENGTH and center drilling is handled in special Sundstrand machines. One operator runs two machines. Opposed heads first drill centers at each end of a shaft, then the machine indexes to bring in a second pair of opposed heads for milling ends to length

Pontiac's 100% Switch to Shell Molded

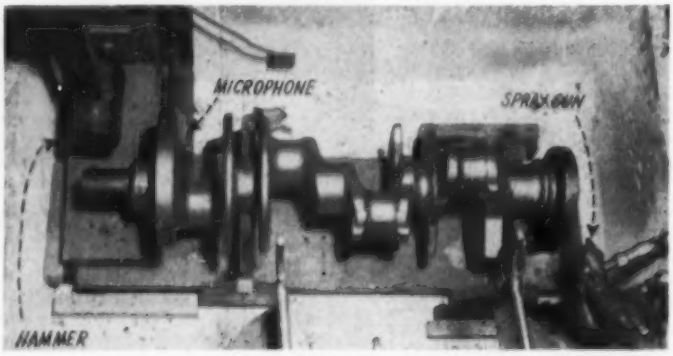
DANVILLE, ILL — 2400 Pontiac crankshafts per day are shell-molded here by Central Foundry Division, GMC, after several years of development and retooling. Shafts are of pearlitic malleable iron with characteristics of low-carbon steel.

Machinability is rated a third better than that of SAE 1045, considerably better than that of steel forgings. The material is less abrasive, so tool life is up 10 times for carbides, quadrupled for HSS. Biggest advantage, however—and the one that may bring in other GM divisions—is that only 10 lb are machined from a 64-lb casting, against 18 lb from a 76-lb forging.

Cast dimensions are so close that counterweight sides need not be machined, and greater uniformity of weight and dimensions makes balancing easier. Physicals are at least equal to those of forgings, resistance to wear and fatigue is high, exceptional rigidity gives minimum deflection, damping capacity is high.

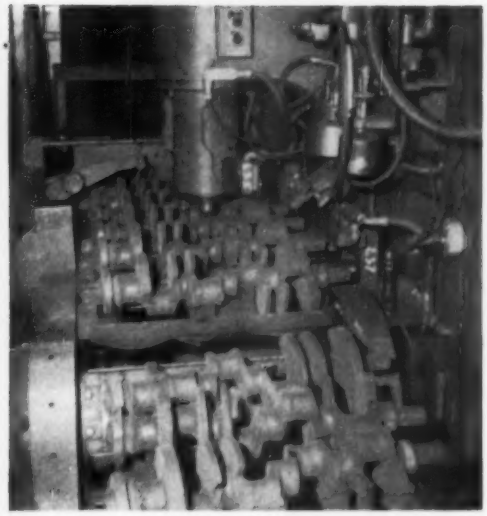
Here are major steps in the process, mostly mechanized:

- Two kinds of sand and phenolic resin from dry bulk-storage units are weighed into power lorries.
- Large mullers mix ingredients, bottom-discharge into enclosed tubular conveyors.
- Overhead bins in shell-making area gravity-feed mix into investment boxes on shell-making machines. Upper halves of boxes on one machine, lowers on another, are preheated to 475 F by Calrod units.
- Pattern is sprayed with wax-water mixture, shell mix invested around them.
- Oven retracts, shells are stripped and mating halves are glued.
- Shells are conveyed to a prepared sand bed, settled in by vibration, then taken to a cope bedder.
- After pouring, molds cool as they approach a "debobbing" station, where air-operated arms remove the shafts and bobs (which provide a place for expanding gases) and sprues are knocked off by swinging pendulums. Shafts, shell and sand are pushed onto an oscillating conveyor that loosens shells and sand so mechanical guides can turn shafts flange-end forward.
- A cooling conveyor lifts shafts and takes them out of the building on a 54-min cycle, back to a Wheelabrator shot-blast cleaner, followed by inspection.



SONIC TESTING for soundness follows concentricity and surface crack checks. Shafts in a test chamber are struck with a hammer. Resulting vibrations must be 4710 to 5030 cps for automatic OK—actuation of a yellow-dye spray gun

Field Report USA:



AUTOMATIC HARDNESS TESTING is done in this special machine. A grinding head produces a spot for a Brinell impression. 241 to 269 Bhn automatically actuates a spray of OK dye

Crankshafts

- A walking beam picks up shafts, paces flow to grinders where fins are removed. Work is held in cradles while grinding, then to inspection.
- Annealing trays are loaded, go on powered rails to automatic 3-tray dispatch carriers. Controlled by pushbutton, carriers lift and go to predetermined rail stations. They are manually started along rails to an elevator which takes them into a quench kiln for annealing and rapid air cooling.
- Trays go to a draw furnace, then to a holding furnace preceding . . .
- Automatic straightening in a 500-ton HPM hydraulic press.
- Cooling-conveyor circuit outside, then to spot grinding Brinell-hardness test, and unloading on rails (see photo)—all automatic. Gates on pin ends are removed in special Sundstrand millers as shafts index in special hydraulic fixtures.
- Final cleaning in a second Wheelabrator with automatic conveyor.
- Concentricity checked in special paddle gages. Shaft rotated on centers in contact with dial indicators at each bearing. Good shafts go on a conveyor through an electromagnetic coil and Magnaglo spray, then are checked in an ultraviolet booth.
- Final inspection includes a sonic test (see photo).

FIELD REPORT (continued)

up a $10-million guided missile research and development plant at Denver, Colo . . . **Westinghouse Electric Corp** has earmarked $20 million for "new enterprises in the atomic equipment field" in the last year . . . **Shallway Corp,** Connellsville, Pa, has set up a shell molding research and development center, designed as a "clearing house for exchange of technical information relating to shell molding pattern and core-box design." Sample molds, cores and castings are being brought in from all over the US, Canada, and Europe for test . . . **Alan Wood Steel Co** will set its **Penco Metal Products Division** up in a new, air-conditioned plant now being built on a 45-acre site at Oaks, Pa. Company will lease the building from its constructor, Robert E Lamb & Son, Philadelphia . . . **Wyman-Gordon Co,** Worcester, Mass, has increased the number of hydraulic presses at its plant there to six with the installation of a double-acting 1500 tonner built by **Birdsboro Machine & Foundry Co.**

Midwest...

Midwestern newsnotes . . .

Auto and truck manufacturers will spend a record $2 billion this year for new plant and equipment in preparation for "a golden decade of prosperity" . . . **J I Case Co,** Racine, Wis, manufacturer of agricultural machinery, is in the market for "any acquisitions beneficial to the stockholders," has been talking merger with another big farm equipment maker, **Minneapolis-Moline Co** . . . **Electric AutoLite Co** will boost manufacturing space at its Sarnia, Ontario, plant 75%, and will spend $500,000 to equip its Bay City, Mich, plant with facilities to produce stamped anodized aluminum auto grilles and trim . . . **Detroit Steel Products Corp** will spend $20 million on improvements to its Portsmouth, Ohio works, part of $90 million to be spent on modernization and expansion by 1957's end . . . **McDonnell Aircraft Corp, St Louis,** has a new $55 million Navy order for F3H-2N Demon jet fighters . . . **Burdett Mfg Co,** Chicago industrial heating equipment makers, will move to a new 34,000-sq-ft plant at 4920 S Monitor Ave, Chicago . . . **Novo Pump & Engine Co,** Lansing, Mich, has acquired 90% of the capital stock of **Brown Industries Inc,** Sandusky, Ohio, ferrous castings producer . . . **American Can Co** is planning to build a 200,000-sq-ft. can plant in Woodlawn, Ohio, a Cincinnati suburb . . . **Rotary Seal Co,** Chicago, has merged with **Muskegon Piston Ring Co,** Muskegon, Mich. Rotary will become a subsidiary . . . **Magnavox,** Ft Wayne, Ind, radio and TV manufacturer, has bought out **Sentinel Radio Corp,** Evanston, Ill . . . **R G Haskins Co,** Chicago manufacturer of grinding and polishing equipment, has purchased the **N A Strand Division of Franklin Balmar Corp.** Strand, which makes products competitive to those of Haskins, will be operated independently as the **N A Strand Flexible Shaft Co,** Chicago . . . **General Tire & Rubber Co's Industrial Products Division** has acquired manufacturing and distribution rights to the **Carter Jiffy Tire** for bandsaw wheels from **Carter Products Co Inc,** Grand Rapids, Mich . . . **Superior Tool & Die Corp,** Detroit manufacturer of dies and special machinery for the automotive industry, has been acquired by a Toronto financial combine . . . **Cutler-Hammer Inc,** makers of electric motor controls, will build a $2 million, 175,000-sq-ft plant in Milwaukee, employing 350 . . . **Martin-Parry Corp,** Toledo manufacturer of metal wall partitions and vacuum cleaners, will combine with **Prosperity Co, Inc,** Syracuse, N Y, and the **New York & Cuba Mail Steamship Co** into **Ward Industries Corp** . . . **Bohn Aluminum & Brass Corp,** Detroit, has bought out **Betz Corp,** maker of heat transfer equipment, as a diversification move, will make it a subsidiary . . . **Inland Steel Co,** Chicago, will spend $75 million on expansion this year, part of a three-year $260 million program . . . **Boeing-Wichita** recently turned out its first B-52 Stratofortress . . . **Trane Co,** La Crosse, Wis, manufacturer of air conditioning and heating equipment, is adding 24,000 sq ft to its Plant 6 . . .**Square D Co's** new Cedar Rapids, Ia, plant has just passed the 400-employee mark . . . **Allis-Chalmers Mfg Co,** Milwaukee, reports sales of more than $535 million in 1955—highest in the history of the company . . . **Owatonna Tool Co** is building a modern plant and offices, will move in sometime next year . . . Machine tool tycoon Frederick W Richmond has pulled out as board chairman of **Gear Grinding Machine Co, Detroit,** and its subsidiaries, **Detroit Bevel Gear Co,** and **Republic Gear Co** . . . **Borg-Warner Corp** will close down its Wooster, Ohio, plant.

Stamping Inroad into Castings Foretells Rosy 10-Year Outlook

CLEVELAND—The U S stampings industry can look forward to an even faster growth in the next decade than the spectacular expansion that has characterized the last 10 years—and the reason lies in the development of new metal stamping methods that are making inroads into foundry business. That's the optimistic outlook of members of this $3 billion industry attending the sixth annual Spring Technical meeting of the Pressed Metals Institute here March 14-16.

There was plenty of cause for optimism at the Cleveland meeting —paradoxically because attendance was lower than 1955's spring session. But this is why: sudden and large stampings orders placed with a number of companies during the last three weeks made it necessary for many members to stay on the job at their home plants.

A PMI innovation this year was the breaking up of the meeting into 30-man-or-so groups to talk shop practice and procedures, with the overall subject of "Methods of Reducing Press Set Up Time." In each group, members were asked to tell how their respective plants overcame tough problems along this line.

The medium heavy and large stamping group spent most of its time figuring ways to increase the efficiency of the die setter. Some of the ways: advantageous placement of the die storage room, careful and prompt inspection and repair of tools.

The small, light stampings people heard how one firm gages steel by using a roller-micro switch setup that can be set for any wanted gage, and that can stop the press when over- or under-gage steel starts feeding into the press. Most members said they gage steel by spot inspection, preferring to rely on the steelmaker delivering as specified.

Only a few of the men making up this group thought much of spray lubrication — most claiming too much lubricant is deposited by the fog-mist method. Best way to apply lubricant to a coil strip, they felt, is the old reliable oil-saturated felt pad. One man said his firm employs a pumping device with pinpoint controls to regulate the amount of lubricant.

On the question of how the part is removed from the die, one member said his company has been forced to discontinue the compressed air method because workmen complained of the noise. Aside from using air, most members agreed, the die design should be such as to permit the part to be pushed out through the bottom — then via a chute with textile cushions as brakes, into a shipping container.

Spelled-out instructions for checking parts on specification and setup sheets are important, members said, especially for parts produced on high-speed presses. Usual procedure is to have floating inspectors check parts, but in shops where the operator has plenty of time, he can do it.

Small lot stampings group talked over the urgent need for standardization of shut heights, pin layouts, sizes and heights of dies, and bolster clamping hole layouts, tool arrangement, and designing of tools into the press.

Jack Kleinoder of Volkert Stampings Inc, Queens Village, N Y, apprentice chairman of the National Tool & Diemakers' Association, urged an industry-wide step up in the training of tool and diemakers. Practicing what he preaches, Mr Kleinoder told how his company has 12 apprentices constantly in training under full-time direction of a journeyman.

The day isn't far off, Mr Kleinoder said, when industry will need three times as many trained tool and diemakers as it does today, and the only way to get them is a tremendous industry-wide increase in training.

Metalworking Unions Pledge Mutual Aid

WASHINGTON—Metalworking unions in the automotive, steel, shipbuilding, electrical and other industries are forming a mutual aid alliance with AFL-CIO's new Industrial Union Department.

Headed by Walter Reuther, the department has as its aim the sharing of information between unions on collective bargaining and economic programs. The idea, says Reuther, "is to pull together those unions with a common interest."

Herbert I Segal, a director of Van Norman Industries, Inc, has been elected president of the company

Herbert I Segal, elected president of Van Norman Industries, Inc, Springfield, Mass, succeeds **James Y Scott.** Mr Scott, who has resigned as president, a director, and chairman of the board of all the company's operating subsidiaries, is an ex-president of the National Machine Tool Builders' Assn. Mr Segal is also president of Segal Affiliates, Inc, New York City business counsellors; chairman and director of Hasco Machinery Co, Newark, NJ, distributor of machine tools.

During World War II he served on the advisory panel of the OPA Price Committee on Used Machine Tools. He was executive chairman of the Machinery Dealers Institute from 1942-45.

Also Heads Subsidiaries

In addition to his duties as president, Mr Segal will serve as chairman of each of Van Norman's subsidiary companies. Working with him in New York will be a group of specialists in manufacturing, management, and financial control to supervise and coordinate the operations of the following subsidiaries: Van Norman Machine Co and Van Norman Automotive Equipment Co, both of Springfield, Mass; Morse Twist Drill & Machine Co, New Bedford, Mass; Super Tool Co, Detroit; Insuline Corp of America, and Transitron Inc, both of Manchester, NH; and H W Butterworth & Sons Co, Bethayres, Penna.

Hess Takes on Added Duties

Donald P Hess has added to his responsibilities as Van Norman's board chairman the resident vice presidency at Springfield.

Dr John W Harriman is vice president for finance, and **Reginald W Porter** treasurer and clerk.

Eugene C Clarke, Jr, general manager of Chambersburg Engineering Co, has been elected president of the company; he succeeds his father, who is retiring from active management, but will continue to serve as a board member

Roland Lehr, formerly sales manager of the Quincy Compressor Co, has become president and general manager of Baker Brothers Inc, Toledo (see below)

Roger F Waindle has been appointed chief of the castings branch, Iron & Steel Division of the Business and Defense Services Administration. Mr Waindle, vice president of Misco Corp, and president of Wai-Met Engineering Co, is former board chairman and president of the American Society of Tool Engineers

Names in the News . . .

Roy H Heidenbrand, assistant manager of the Threadwell Tap & Die Co, Greenfield, Mass, subsidiary of The Sheffield Corp of Dayton, Ohio, has been named manager of the division. He succeeds **Paul W Polk,** recently appointed executive vice president of Sheffield (*AM*—Feb 13, '56, p190).

Andrew B Pulliam has been named director of manufacturing services for Borg-Warner Corp. He was previously associated with the New York Central System as chief industrial engineer. **James E Butler,** field sales manager of the Industrial Division of Borg-Warner Corp's Atkins Saw Division, has been appointed sales manager for both Atkins Sales Divisions, Industrial and Hardware. **B L Owens,** general sales manager of Atkins Saw Division, has been named director of sales.

A L Baker has been named chairman of the board of Baker Brothers Inc, Toledo machine tool manufacturer. **Frederick W Richmond** and **Leonard Levine** have resigned from the board of directors. Their holdings in the company have been acquired by the new president, Roland Lehr (see above).

John P Roche, executive vice president of Heppenstall Co, has been elected president. He succeeds **R B Heppenstall,** named chairman of the board.

Roderick M Menoch, formerly on special assignment at the Dodge Main Plant, has been named manager of manufacturing services for Chrysler Corp's newly organized Forge & Foundry Division. **Robert B Boswell,** supervisor of production metallurgical control in the Engineering Division, has been appointed chief engineer of the Forge & Foundry Division.

Charles L Holbert, formerly executive vice president of Southern Pacific Milling Co, Ventura, Calif, has joined H K Porter Co, Pittsburgh, as a vice president. **Arthur S Nippes,** formerly works manager for the Elliot Co, Jeannette, Penna, has been appointed assistant general manager in charge of manufacturing for H K Porter's Henry Disston Division.

John E Barbier, manager of Jones & Lamson Machine Co's Thread Tool Division, has been named to the newly created post of manager of engineering for the company. **W F Couts,** sales manager of the Division, succeeds Mr Barbier.

OBITUARY

John H Van Deventer, 74, engineer and editor of industrial publications, died at his home in Brewster, NY, March 5. He became associate editor of *American Machinist* in 1915 and editor two years later. During World War I he took a year's leave of absence to organize and direct a program to develop gages for munitions manufacture. After his return to *American Machinist* he was one of the group that organized the Army Ordnance Association (now the American Ordnance Assn) which was financed during its first year by *American Machinist*. After his resignation in 1919, he edited several industrial engineering journals. Mr Van Deventer became editor of *Iron Age* in 1930 and held that post until 1946. He was a chairman of information for the Committee for Economic Development from 1947 to 1949.

New Shop Equipment,

TRIPLE-ACTING HYDRAULIC PRESS, normally mounted at floor level, was erected in pit at builder's plant to provide crane clearance

Hydraulic Press Has Servo Controls

Equipped with a magnetic-hydraulic servo amplifier control system, and using a closed-loop feedback system to provide additional control, a new triple-action, 575-ton, hydraulic drawing press has been developed by the A B Farquhar Division, The Oliver Corp.

An outstanding feature of the press is that it can be programmed to provide any desired sequence of operations, and all controls are centered on a panel within easy reach of the operator. Ram speeds are variable from zero to maximum by a simple dial setting, and ram stroke can be started, stopped, or reversed by rotating a radio-type dial that operates a servo system. Blankholder pressure is maintained by a separate pump and four independent cylinders, each of which can be individually controlled. Thus, if wrinkling at one corner indicates that additional pressure is required at that point, a simple turn of a handwheel on the control panel will provide the increased pressure, which will be shown on a gage.

A typical operational sequence might be: Load work and press cycle button. Blankholder and ram make rapid advance until precision limit switch is tripped. (Approach speed is preset by control panel dial, position of limit switch is adjusted by leadscrew.) Ram and blankholder slow down to pressing speed, as preset on control panel, and continue until draw is complete. If desirable, however, drawing speed may be increased or reduced during the stroke by merely turning the dial. At the end of the stroke, ram is reversed by either a limit switch or a pressure switch and withdraws at controllable speed. After stripping, ram makes rapid withdrawal until it is within a short distance of the blankholder, when it slows again to pick up the latter without violent impact. After pickup, ram and blankholder withdraw at maximum speed to the up stop position. The speed during each part of the cycle, and the position at which it is changed are adjustable at will, and settings may be recorded on a card to be kept with the dies to substantially reduce setup time.

The electrical system was developed specially by Raytheon for use with the Oilgear DY control system used on the press and is entirely electromagnetic, no electronic tubes being used. The hydraulic system was developed by Oilgear and permits smooth, shock-free reversal from full stroke down to full stroke up in less than 0.75 sec, thus avoiding dangerous surges in the lines and preventing leaks at joints. As supplied on this first press for the US Navy, there are six speed changes available for the complete cycle, but additional speed control units can readily be incorporated to provide additional multiples of six.

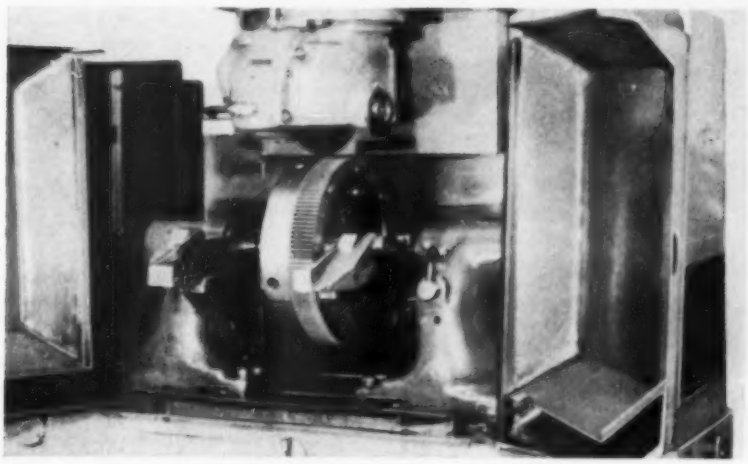
The press housing is fabricated of heavy plate weldments, and wear surfaces are lined with replaceable Formica ways. Gibs are fully adjustable. Oil coolers are provided to maintain oil at optimum working temperature, and the entire press is shielded to prevent radio frequency interference from 40 kc to 1000 megs. Semi-automatic or full automatic operation can be obtained, with control by one or two operators, as desired.

Under normal conditions the control panel will be mounted directly on the press, but it can be arranged for remote control if the press is to work on radioactive or other dangerous materials. Similarly, it lends itself readily to incorporation into an automated production line.

A B Farquhar Div, Oliver Corp, York, Penna

CONTROL PANEL, shown mounted on press, can be arranged for remote control

Materials and Parts . . .



Red Ring Gear Shaving Machine Finishes Gears up to 24-in. PD

Improved model GCP gear-shaving machine for finishing external and internal spur and helical gears will handle work up to 24-in. pitch diameter. Unit is equipped with loading rails that enable external gears to be easily loaded in and out under the shaving cutter, which is above work.

When internal gears are shaved, swivel workhead and internal cutterhead attachments are provided. Hollow spindle in workhead permits shaving of parts with integral shafts. Swivel workhead permits work to be swung out toward operator for easy loading and unloading. Cutter on internal cutterhead is brought into mesh with work gear and locked in one motion. Work gear drives cutter when internal gears are being shaved. For external gears, cutter drives work on the machine.

Unit will shave external gears from 3 to 24-in. PD in the 2-to-16 diametral-pitch range. Internal gears from 6 to 24-in. PD in same tooth-size range can be shaved on machine. Crown shaving is accomplished by Red Ring rocking-table action.

Slide mounting of cutterhead on improved model maintains gear working heights over wide range of gear sizes. Separate motor drive provides automatic in-feed of work at end of stroke as it passes back and forth across shaving cutter. Cutter spindle rotation and table reciprocation are also accomplished with separate motor drives.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

Fluidized Powder Coating Is Corrosion Resistant

Fluidized-coating process provides corrosion-resistant coatings of polyethylene, polyfluorocarbons, nylon, and other plastics on metallic and dissimilar plastic-molded targets. Key to process is dual-purpose unit called Powder Fluidizer which consists of compressed-air distribution system for maintaining plastic powder in a dense, dry turbulent state. Targets to be coated are preheated, then immersed in fluidized bed for a few seconds, so that a uniform coating up to 3/16 in. thick is obtained. When heated object is removed, residual heat is usually sufficient to melt and level adhering powder particles to a smooth, non-porous resin cladding. Fluidizer is also equipped with a spray unit which fits over top of fluidizing chamber, so that parts too large to fit into chamber can be coated.

American Agile Corp, 5461 Dunham Rd, Maple Heights, Ohio

. . . including

MACHINE TOOLS AND ATTACHMENTS

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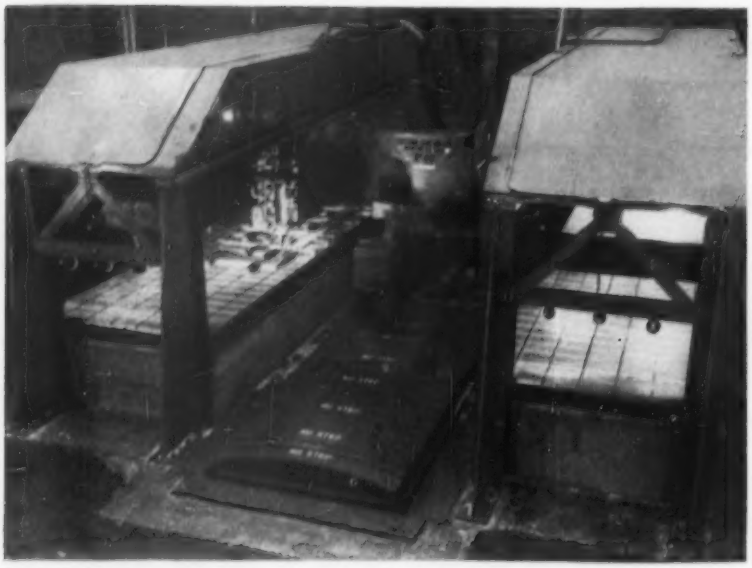


PARALLEL TABLES FLANK BEDWAYS on Model 410 Cav-Ro-Mil. Machine can travel full length of tables

Convair Heavy-Duty Miller-Routers Guided by Overhead Templet

Convair Div of General Dynamics Corp has partially solved the problem of machining large aircraft parts by using two Ekstrom, Carlson machines, called Cav-Ro-Mils, for heavy-duty straight milling, cavity milling, and routing of thick aluminum plate and forgings. Model 400 is stationary machine set between two worktables, located 88 in. apart, of 6 x 12 ft and 5 x 12 ft size; larger table has 12-in. bolster plate removable for machining thick work. Model 410 travels on bedways between two 6 x 25-ft tables 100 in. apart.

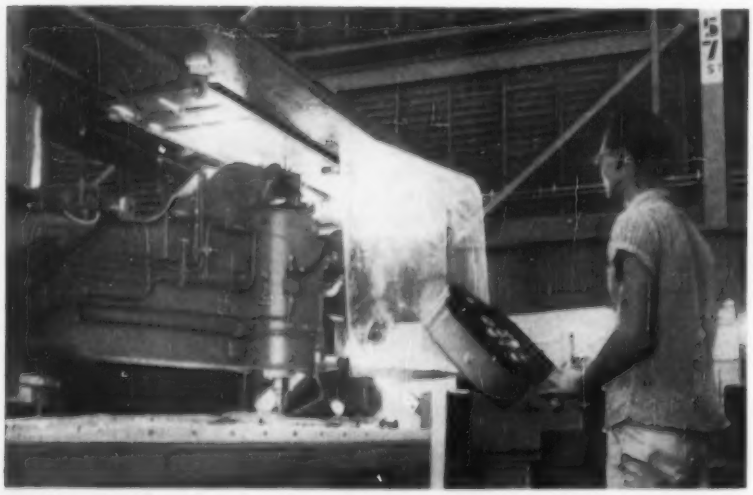
Each machine has two sectional arms, 66½ in. long, connected to each other and actuated about a fixed point. Inner arm rotates 360° in any one direction and returns; outer arm follows the profile and carries the milling head, which houses a water-cooled motor. Machine feeds are hydraulically operated and sectional arms are electrically actuated.

Design of machines incorporates overhead templet, which is secured in holder located above each table. Templet follower is centered directly over cutter at top of router head, so that cutter is guided in direct 1-to-1 ratio as follower traces along templet. "Joystick" control of the follower is from a portable remote-control unit, protected from work by a plastic screen. First workpiece is positioned on the table by tooling holes which correspond with holes in the templet above; centering of holes is accomplished with follower. Thereafter, the piece can be set by locators.

Machines offer many advantages, according to builder: large parts can be machined with fewer setups; large cavities can be milled; material is removed rapidly; after setups have been made, one workpiece can be machined while another is being set up on opposite worktable.

Additional specifications for both machines: vertical travel of spindle head, 8 in.; vertical travel of overhead follower, 5 in.; spindle-motor speed, 3600 rpm at 60c and 7200 rpm at 120c. Model 400 has routing area of 6 ft x 123 in.; routing area of Model 410 is 6 x 23 ft.

Ekstrom, Carlson & Co, Rockford, Ill



PORTABLE CONTROL PANEL operates Model 400 miller-router, which is guided by overhead templet. Operator is protected by Lucite panel

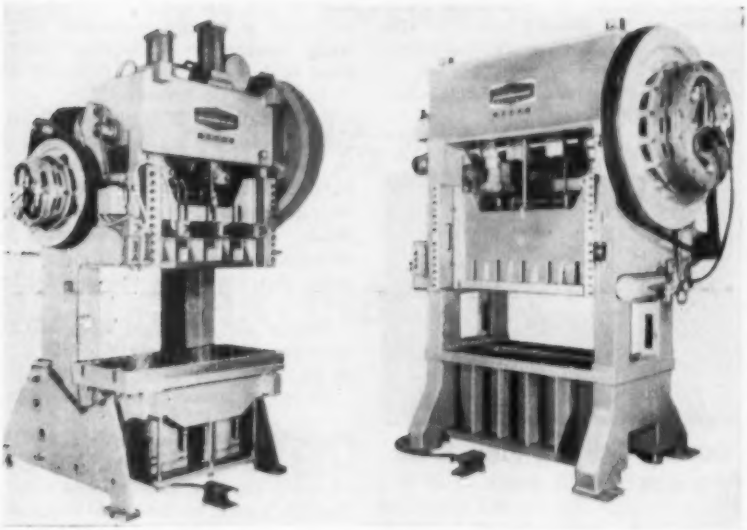
Norton Dual-Electric Indicator Measures Swivel Table Adjustment

Swivalign is designation for device, intended to provide accurate control for grinding close tapers, which measures swivel table adjustment. Device, applicable to Norton cylindrical and universal grinding machines, simplifies adjustment of swivel tables to correct errors in grinding exact tapers or to eliminate taper in straight work.

Indicator consists of one electrical pick-up unit with zero adjusting knob at each end of swivel table and a two-channel amplifier having a pair of indicating meter elements reading on a common scale. Each meter needle responds to movements of only one of the pick-up elements. Connections are so arranged that both needles move in same direction of rotation as swiveling of table.

Divisions on meter scale indicate directly taper changes in thousandths of an in. per ft of taper. Two ranges of readings, with graduations of 0.0001 in. per ft and 0.0005 in. per ft of taper change, are provided.

Norton Co, Worcester 6, Mass



Johnson Mechanical Presses In Double-Crank Design

Two double-crank press lines, both featuring box-type rams, large bed areas, steel construction, low-inertia clutches, and electrical controls have been announced by Johnson Machine & Press Corp. Lines are available as high-speed blanking flywheel-type presses with variable-speed drives up to 300 spm, or as back-geared presses for drawing, forming, punching, or piercing jobs.

Line designated "52" is straight-side series available in capacities of 30, 40, 60, 80, 100, and 150 tons. 80-ton Model 52-30 (illustrated at right) has 52 x 30-in. bed, with 48 x 30 x 3½-in. bolster plate, 48 x 24-in. ram face, and 36 x 6-in. bed opening. Diameter of main bearings is 43¼ in., and diameter of Pitman bearing is 5¾ in. Crankshaft has 2-in. stroke and shut height over bolster is 18 in. Unit has 3-in. slide adjustment and performs at rate of 60 spm.

Second line, G-2 Series, is offered in 60, 80, 100, and 125-ton capacities. 60-ton Model 56-22 (illustrated at left) has 56 x 22-in. bed size, 28 x 10-in. bed opening, and 40 x 22-in. ram face. Speed of backshaft is 303 rpm. Geared model makes 50 spm, and flywheel-type press operates at 100 spm.

Johnson Machine & Press Corp, Elkhart, Ind

Constant-Surface Cutting Speed Offered on Monarch Lathe

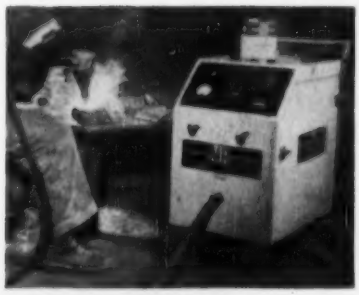
Designed to be used with Model 21 Mona-Matic manufacturing lathe, constant-surface cutting-speed mechanism functions in conjunction with program-controlled, four-cut, fully automatic work cycle of lathe. Mechanism provides automatic variation of drive-motor speed to maintain desired surface-cutting speed on each of the various diameters and contours of each workpiece in the run. Feature is reported to give increased tool life, higher rates of production, and improved work finishes.

During operation, when Multicycle Programer indexes from one cutting cycle to next, causing cutting tool to be positioned for cut, an electrical signal indicating exact distance from tool tip to work centerline is transmitted to constant-surface cutting-speed mechanism. Mechanism then automatically adjusts machine's drive-motor speed and, as a result, the spindle rpm, to produce desired surface cutting speed on work. If drive motor deviates from proper speed, special feedback signal enables constant-surface speed control to compensate for the error.

When contours are turned under control of "Air Gage Tracer" unit of Model 21, mechanism continually varies drive-motor speed, so that required surface speed is automatically maintained at point tool tip is actually cutting. If desired, mechanism can be controlled manually at any time.

Electrical control equipment is housed in a separate cabinet.

Monarch Machine Tool Co, Sidney, Ohio



Amsco Portable Welder for Hardfacing Operations

Model MF welder is designed for manganese-steel and hardfacing work on irregularly shaped parts. Portable unit, mounted on casters and designed to plug into ac or dc welding units by a single cable, operates on a current range of from 150 to 450 amps.

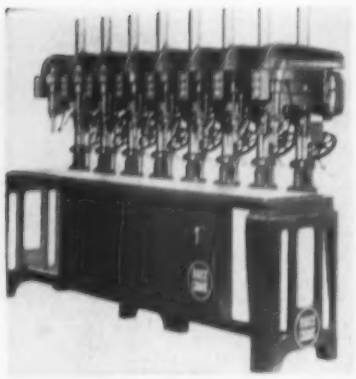
As an accessory for hardfacing, welder serves as semi-automatic device for feeding flux-coated welding wire to parts of machines being refaced with new metal after original surfaces have worn away. Selfing mechanism keeps welding arc constantly supplied with welding wire, at a rate proportional to size of arc. Conical hopper mounted directly above welding-wire outlet provides means of storing and feeding flux. Flux adheres to wire by magnetic field created by welding current, and each one-quart refill from hopper serves for 15 min of welding.

In operation, welder produces a visible arc which fuses metal and flux upon the metal being welded or built up; at same time, flux serves as means of obtaining desired hardfacing composition. Fluxes available include manganese steel, martensitic iron, and martensitic steel. Same welding wire serves for most types of manganese or hardfacing work.

Amsco Div, American Brake Shoe Co, Chicago Heights, Ill

"Long Jaw" hinged pipe vise has reversible lower jaws milled on both sides. Jaws are fastened from the top, can be easily reversed or replaced without removing vise from bench. All cast parts are made from malleable iron; screw and handle are of cold-rolled steel, and ball ends are forged from handle stock. Vise is equipped with bender for small pipe. Tool is available in four models ranging in pipe-capacity sizes from ⅛-2 to ⅛-4½ in.

Columbian Vise & Mfg Co, Cleveland, Ohio



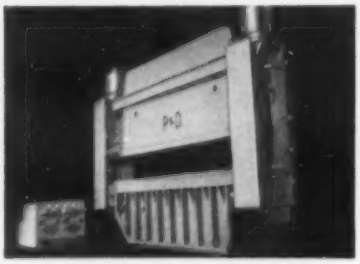
Multiple-Head Models in Drillpress Line

Boice-Crane drillpress line is offered in standard 6- and 8-spindle models, with units of 10, 12, 16 or more heads available on special order. Multi-head models are addition to line, which previously offered four-spindle model.

All models are available in either Helmet Head ⅝-in. or Challenger ½-in. line. Flexibility is afforded in such items as automatic feeds, 2-speed motors, spacing of heads or bases, remote controls, and indexing workholders.

Company also offers special engineering service for tailoring drillpresses to the specific needs of any industry. Brochure describing line is available.

Boice-Crane Co, 935 W Central Ave, Toledo 6, Ohio



1000-ton Hydraulic Press Brake

Unit with over-all length of 26 ft 1 in., width of 4 ft 6 in., and height of 16 ft 5½ in. has open-end housings to permit passage of work through it up to over-all length of pressing surface. All models are furnished with automatic, sensitive ram-leveling device, as well as a ram tilt feature.

Four different ram speeds can be provided, by re-arrangements within pumping units, with wide adaptation of working cycles. All obstacles to passing work quickly and easily through the press have been removed in order to handle unusually large work relative to press size. Heavy steel plate up to ⅞ in. thick by 19 ft long can be processed.

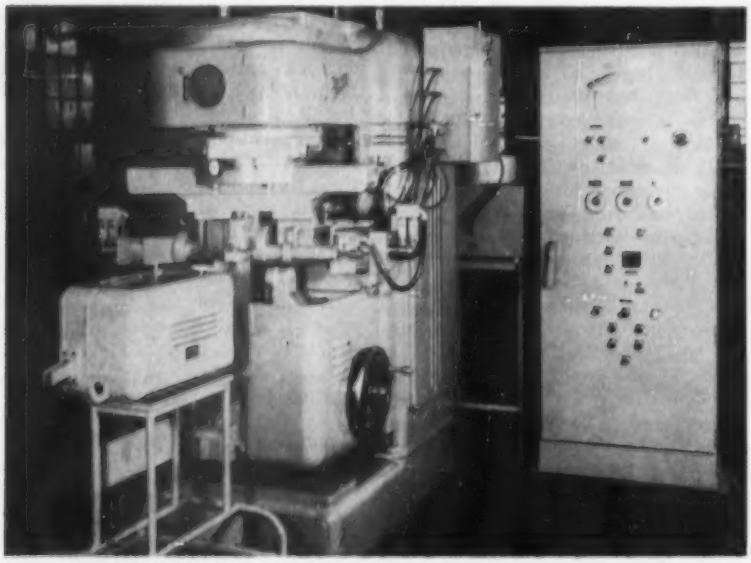
Specifications: 20 ft between housings; stroke, 16 in.; open height, 33 in.; closed height, 17 in.; ram speeds, 28½ to 89½ ipm down free; 4½ to 48 ipm pressing; 58 to 93 ipm return. When ram reaches approximately ¼ of tonnage capacity it will automatically slow down to 4½ or 13 ipm pressing speed.

Models are available from 500 to 2000-ton capacity; lengths from 6 to 30 ft.

Philips & Davies Inc, Kenton, Ohio

Plane swivel joints provide for up to 360° turning or rotating motion on machinery or other places where flexible piping or tubing is required. Available in ball bearings and thrust bearing types suitable for pressure as high as 2000 psi, depending on size of joint. Standard sizes are ¼ and ½ in.; ⅜ and ¾ in. are available on quantity orders.

Barco Manufacturing Co, 500 North Hough St, Barrington, Ill



AUTOMOTIVE GEARS are finished automatically in setup of Michigan Tool Co; line consists of underpass gear shaver with vibrating hopper feed, automatic loading, 3-way probe-type gear classifier, and control panel. In addition to controlling machine operation, panel counts correct-size gears and keeps track of oversize and undersize gears. Feedback system actuated by gear classifier through control panel automatically corrects center distance when gears come oversize or undersize. Stub arbors on both headstock and tailstock are air-operated. Rate of production is 260 per hour—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich

Carbide Finisher Eliminates Diamond Wheels

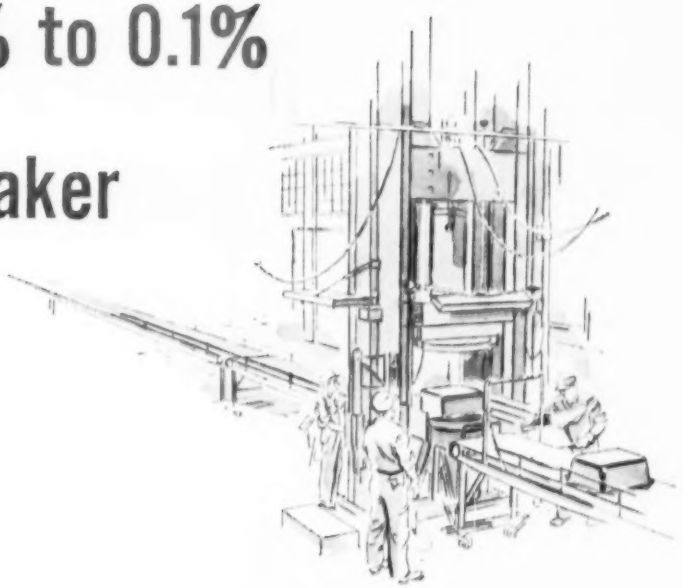
Micro-A Company's Micro-Carbide finisher is reported to produce finishes down to 1 mu-in. Instead of diamond wheels, machine uses diamond-charged lapping disks.

Finisher comes equipped with two finishing disks, two 12¼ x 8-in. cast-iron tables, scales and indicator for table setting adjustable 30° up and down, locking door for diamond compound storage, heavy cast-iron base, mobile lamp, and flat top guard.

Enclosed motor and reducer are equipped with sealed ball bearings; single- or three-phase motor is available. Machine is offered in either cabinet or table model, at cost of $329 or $279.

Distributed by Boylhart, Lovett & Dean, 601 S Rampart Blvd, Los Angeles 57, Calif

Deep-draw rejects cut from 10% to 0.1% when sink maker switches to Pennsalt



drawcote

SOME BENEFITS OF USING DRAWCOTE AND OTHER FOS PROCESS CHEMICALS

CONSISTENT RESULTS. The uniform, fast-drying immersion coating, unlike wet lubricants applied at each press stage, covers the stock completely and with the correct lubricating thickness, usually remaining for two or three press stages.

INCREASED DIE LIFE. Dies forming metal coated with Pennsalt FOS lubricants are protected from galling and welding, last substantially longer and require much less upkeep than dies worked with wet lubricants.

SIMPLIFIED STORAGE. DRAWCOTE®, FOSCOAT®, and FOSLUBE® can be applied well ahead of the drawing or stamping stage—even by the metal-stock supplier—and blanks can be stored ready for use at any time. No need to recoat before forming.

A BETTER START FOR YOUR FINISH. Easily cleaned off *at any time* before the finishing process, Pennsalt FOS lubricants leave no oil films or smuts to mar plated, vitreous, or organic finishes. Costs come down all along the line.

TRUE STORY: One manufacturer of steel kitchen sinks cut his deep-draw reject rate of ten to fifteen percent down to the negligible rate of *one in a thousand*—simply by switching from wet drawing compounds to dry, uniform DRAWCOTE.

DRAWCOTE eliminated this manufacturer's need to clean drawn parts before welding together. Improved shop cleanliness was immediately apparent. And the production line's worst bottleneck was cleared up.

LEARN THE FACTS — find out what other deep-draw and cold-forming shops are accomplishing with the Pennsalt FOS PROCESS of specialized lubricants. Ask your Pennsalt service man or write Metal Processing Dept. 269, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: Woolsey Bldg., 2168 Shattuck Ave., Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

Pennsalt Chemicals

Metal Cleaners • Phosphate Coatings • Cold Working Lubricants

A BETTER START FOR YOUR FINISH

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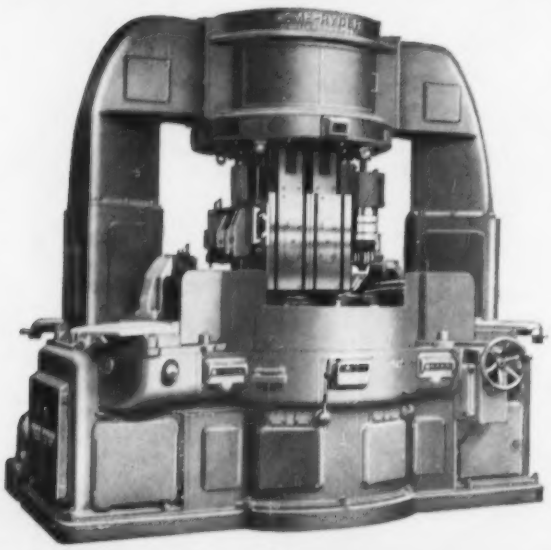
8-SPINDLE VERTICAL HYDRAULIC



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of what you need in a Vertical Chucker

- ★ Sturdy arch frame and massive base construction provides rigid support for top housing and vertical toolslide column.
- ★ Four independently-operated cross slides.
- ★ Feed control of all toolslides by positive cam control.
- ★ Eight vertical toolslides for end-working tools and attachments.
- ★ Wide range of feeds and spindle speeds, with 3-speed selectivity at each work station.
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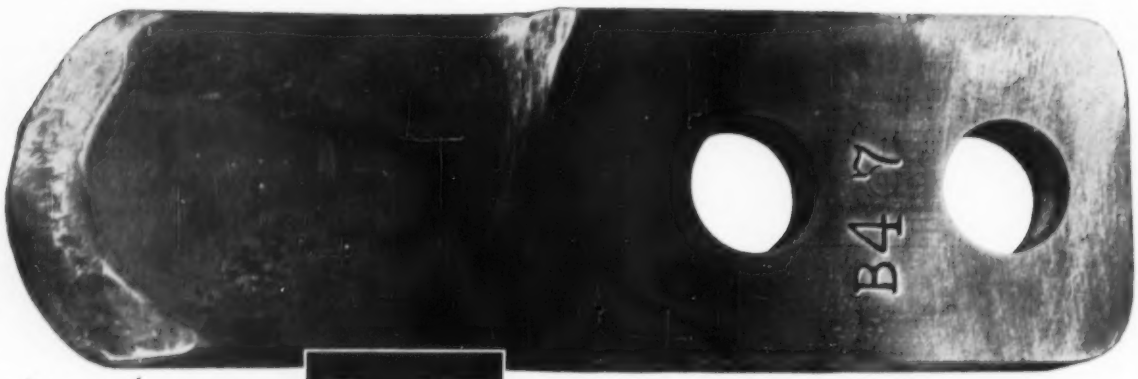

This punch gave double service!

This block had double life!

This die lasted 50% longer!

B-47 HOT WORK STEEL

gives you more runs for your money

. . . anywhere from 1½ to 5 times the Performance!

SOME TYPICAL EXAMPLES

B-47 dummy blocks, vs. 9% and 12% tungsten types, extruded more than twice as many brass and copper tubes. B-47 dies outperformed 12% tungsten type 1½ to 1.

B-47 punches, vs. low-carbon 18-4-1 type, hot pierced more than twice as many eyes in steel axes. See top picture.

B-47 die inserts, vs. 9% tungsten types, hot pressed more than twice as many steel side gear forgings. B-47 die inserts, vs. regular insert material, performed better than 5 to 1.

B-47 dummy blocks, vs. 5% tungsten-5% chromium types, extruded twice as many copper and brass tubes and rods. B-47 dies outperformed 12% tungsten-12% chromium type.

B-47 punches, vs. 5% chromium type, hot extrusion forged 1½ times as many automotive steel front axle spindles.

B-47 die inserts, vs. 9% tungsten types, extruded 1½ times as many high alloy steel automotive valves. This is considered a very difficult job for any grade of hot work steel.

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for "Blue Sheet" on Grade B-47

This four-page folder gives technical data on B-47 for brass extrusion dummy block and dies, valve extrusion die inserts, hot punch tools, forging die inserts, press forging dies, and hot work in general. *Write for your copy today.*

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Looking for a better hot work steel? You'll find it in B-47—an improved chromium, tungsten, cobalt, vanadium type whose superiority is established by actual performance runs such as those summarized above. All tests show that B-47 has unusual resistance to shock and abrasion at elevated temperatures.

Developed originally for applications in the copper and brass industry, B-47 has given excellent results on difficult hot work jobs on steel. B-47, when properly heat treated, exhibits a well rounded combination of red hardness, toughness, and resistance to wear and heat checking that makes it a valuable addition to the Allegheny Ludlum group of hot die steels.

Put B-47 to the test. You'll find that it will do any number of severe hot work jobs without washing out or changing size. Get in touch with A-L, today. Let us help you to use B-47.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

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MACHINES AND ATTACHMENTS

1 MACHINE TOOLS — *South Bend Lathe Works, South Bend 22, Ind.* 80-page Golden Anniversary catalog covers entire line of engine, toolroom, and turret lathes, shapers, pedestal grinders, drillpresses, and new vertical spindle milling machine and 13-in. swing turret lathe. Attachments and accessories included.

2 HEAVY-DUTY LATHE—*Axelson Manufacturing Co, Div, US Industries, Los Angeles 58, Calif.* 20-page bulletin 5504-L-2M contains illustrated data on 32-in. model with 24 spindle speeds from 6 to 750 rpm. Gives construction and operational details, and specifications.

3 INJECTION MOLDING MACHINES—*Hydraulic Press Mfg Co, Mount Gilead, Ohio.* 12-page bulletin 5601 illustrates and describes complete line. Includes operational data, applications, specifications. Design features, engineering information covered.

4 SEMI-AUTOMATIC THREAD MILLING MACHINES — *Hanson-Whitney Co, Div, Whitney Chain Co, Hartford, Conn.* 16-page catalog describes line of "threads-with-one-turn" units. Includes information on cam action, specifications, case histories, special adaptations, tables of feeds and speeds.

5 GRINDERS — *Besly-Welles Corp, Grinder Div, Beloit, Wis.* Condensed catalog lists dimensions and specifications for double horizontal and double vertical spindle disk grinders, radial head face unit, single vertical spindle disk model, and special grinders. Construction details provided.

6 MILLING MACHINE — *Sundstrand Machine Tool Co, Rockford, Ill.* 8-page illustrated bulletin C1-1 describes the C1 Rigidmil for milling small parts. The 5-hp machine has infinitely variable table feed rate. Standard speed range is from 50 to 1500 rpm; optional ranges from 80 to 2400 or 700 to 4300 rpm.

7 VISIBLE GRINDING MACHINES —*Carl Hirschmann Co, Manhasset, NY.* 4-page brochure illustrates method employing specially designed wheel through which work being ground can be seen from start to finish. Contains operating instructions, parts list, description and specifications for Hirschmann grinding machine.

8 GEAR SHAVING MACHINE—*National Broach & Machine Co, Detroit 12, Mich.* 4-page bulletin S-55-11 contains illustrated description of Model GCP-24-in. unit for rotary shaving of external spur and helical gears from 3 to 24-in. PD, and internal from 6 to 24 in. Performs elliptoid or crown tooth shaving. Operating principle, construction features, specifications provided.

9 WIRE FLATTENING MILLS—*Waterbury Farrel Foundry & Machine Co, Waterbury, Conn.* 12-page illustrated circular 731-R gives details on range of 2-high units and auxiliary equipment custom-engineered for specific applications in flattening ferrous, non-ferrous, and clad metal wire in diameters from a few thousandths of an inch up to 1 in. at speeds approaching 3000 fpm.

10 ENGLISH MACHINE TOOLS—*Stanley Sheppard, New York 7, NY.* Bulletins available on 11-in. swing lathe (also model with inbuilt hydraulic copying attachment); 15-in. swing lathe; elevating head vertical milling machines; horizontal milling units; and high-speed radial drilling and tapping machines. Features illustrated, specifications detailed.

TOOLS AND ACCESSORIES

11 SCREW MACHINE TOOLS—*Boyar-Schultz Corp, Broadview, Ill.* 26-page illustrated catalog gives detailed descriptions of complete line including box tools, tools for deep-hole drilling, burnishing and knurling, pointing, recessing; driving units; holders; adapters; toolbit grinding fixtures; chucking levers; cam rollers and pins; hydraulic bar feed; lead-screw tapping attachment. Prices, replacement parts lists, specifications provided.

12 MAGNETIC CHUCKS—*Taft-Peirce Manufacturing Co, Woonsocket, RI.* 22-page catalog 412 covers Super-power line and accessories. Electromagnetic and permanent magnet units described and illustrated. Applications, machining suggestions, data on work drivers included.

13 THREAD PLUG AND RING GAGES —*Besly-Welles Corp, Beloit, Wis.* 32-page catalog with 4-page illustrated visual index has tables of sizes and prices for each type, with AGDS specifications. Use and selection data included.

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14 DIE SPRING SELECTION CHART —*Standard Die Set Manufacturers, Inc, Providence 7, Ill.* 18 x 15-in. wall chart gives complete specification tables for all types and sizes of standard chrome-vanadium springs. Separate table containing maximum recommended deflections for types Y, YM, and YH included.

15 ARO TOOLS AND HOISTS—*Aro Equipment Corp, Bryan, Ohio.* 40-page condensed pocket-size catalog 62 covers line of air tools and accessories; automation tools, including automatic drills with 4-in. stroke and Par-A-Matic drills, ¼-in. capacity; and hoists in ½ and 1-ton capacity.

16 TAP GUIDE WALL CHART—*Wood & Spencer Co, Cleveland 3, Ohio.* Tables include tap pitch tolerances compared with NSTC and Unified Thread Class fits 0-80 through 1½—12; tap drill sizes from 0-80 through 1-27 with basic thread dimensions; suggested speeds; lubricants; rake angles; decimal equivalents terminology.

17 COLLET SELECTION GUIDE—*Hardinge Brothers, Inc, Elmira, NY.* 4-page illustrated bulletin 56 is complete guide for lathes, millers, grinders, and fixtures. Contains specification and dimension charts, conversion and interchangeability listings, prices. Includes data on collets for nose-type collet chucks.

18 CHUCKS—*Horton Chuck Div, E Horton & Son Co, Windsor Locks, Conn.* Illustrated catalog E-200 covers independent, universal, combination, light-duty, two-jaw, face plate and boring mill jaws. Visual reference index provided; each type of chuck with corresponding jaws and parts are in separate sections.

19 PRESS STYLE MARKING DIES—*Jas H Matthews & Co, Pittsburgh 12, Penna.* 44-page illustrated catalog 146-B Series contains descriptions, charts, selection data, techniques, specifications on variety of dies and holders.

20 COUNTERBORES—*Continental Tool Works Div, Ex-Cell-O Corp, Detroit 32, Mich.* Catalog contains complete description of counterbores, countersinks, holders, and pilots.

21 BUR SELECTOR—*Atrax Co, Newington, Conn.* 13¼ x 27½-in. illustrated wall chart gives data on 120 standard solid tungsten carbide burs. Specifications and tool numbers; recommended speed table prescribes correct bur and rpm for work on any material from stainless to aluminum.

HEAT TREATING AND WELDIING

22 FLUXING COMPOUNDS FOR SILVER BRAZING—*American Platinum Works, Newark, NJ.* 16-page manual covers proper fluxing practice. Chart indicates correct selection of flux based on specific temperature ranges and metals to be joined. Data on applications and characteristics of new APW fluxes included.

23 ARC-WELDING PROCEDURES—*Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Penna.* Technical Data Card 155A summarizes recommendations for joining various tubing steels. Indicates proper electrodes, preheating and postwelding heat treatments.

● BRAZING ALCOA ALUMINUM—*Aluminum Co of America, 774 Alcoa Bldg, Pittsburgh 19, Penna.* 134-page illustrated book contains description of standard and specialized brazing processes, materials, and techniques. Tabular data covers methods, typical mechanical properties of wrought and casting alloys, composition, melting ranges, and applications of various fluxes. Request direct on company letterhead.

PLANT SERVICE EQUIPMENT

24 NICKEL PLATING—*Hanson-Van Winkle-Munning Co, Matawan, NJ.* 20-page illustrated manual on Nickel-Lume process describes three techniques for electro-depositing. Bath preparations, conversion of existing baths, solution maintenance, handling of equipment and materials discussed.

25 "TROUBLE-SHOOTING CHART FOR HYDRAULIC SYSTEMS"—*Sun Oil Co, Philadelphia 3, Penna.* 2-color wall chart gives causes and solutions for variety of common troubles.

26 FIRE PROTECTION—*Automatic Sprinkler Corp of America, Youngstown, Ohio.* 27-page catalog 73 covers various methods of detection, prevention, control, and extinguishing by "Special Hazard" systems. Equipment illustrated and described; detailed chart gives data for applications.

PARTS AND MATERIALS

27 SPEED REDUCERS—*Farrel-Birmingham Co, Ansonia, Conn.* 52-page illustrated bulletin 450 gives detailed information on complete line, re-engineered, rerated, and expanded. Contains tabular data on hp ratings, specifications, dimensions, weights, selection.

28 HOSE, FITTINGS, COUPLINGS—*Aeroquip Corp, Jackson, Mich.* 64-page catalog 200 contains detailed engineering data on equipment. Illustrated descriptions cover low, medium, and high-pressure hoses for air, water, fuel, lube, and hydraulic applications; special hoses; and detachable, reusable fittings and couplings. Assembly instructions and parts lists included.

29 IN-LINE HELICAL GEAR DRIVES —*Link-Belt Co, Chicago 1, Ill.* 16-page illustrated book 2651 describes complete line. Covers load classes for 250 applications, overhung load ratings and dimension tables, selection data, cutaway views of both double and triple reduction drives.

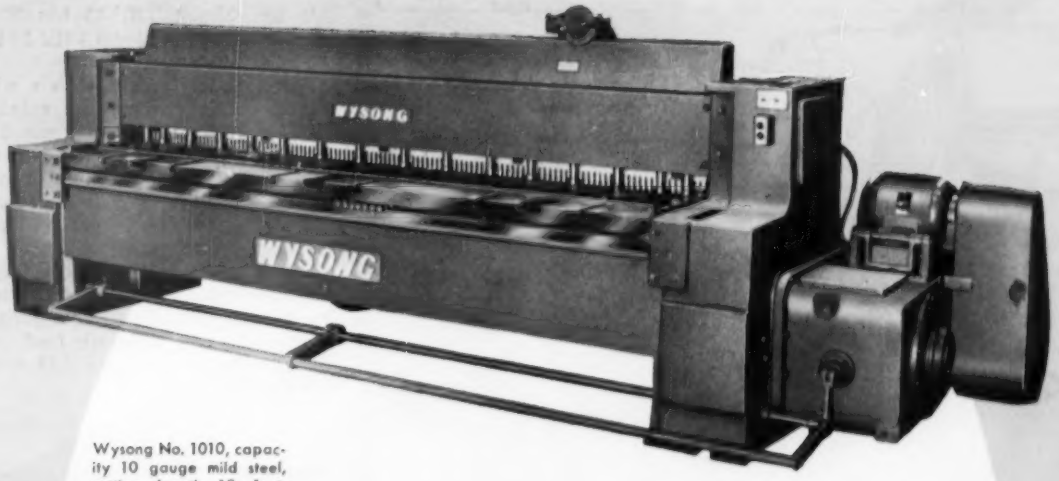
30 ALLOY STEEL—*Lukens Steel Co, Coatesville, Penna.* 25-page booklet describes T-1, a high-strength, readily welded, weight-saving alloy steel. Charts, graphs, engineering data cover material available in thicknesses from 3/16 to 6 in., widths up to 195 in., max length of 720 in.

MISCELLANEOUS

31 TECHNICAL WRITING SERVICE —*Robert B Warman, Inc, Graphic Engineering, Buffalo 22, NY.* 10-page illustrated booklet describes facilities for research, writing, photographic, and technical art services. Organization handles description of manufacture, engineering reports, manuals, technical articles, catalogs, etc.

32 PRODUCT LITERATURE DIRECTORY—*Allis-Chalmers Mfg Co, Milwaukee, Wis.* 24-page booklet B6057 lists alphabetical description of products and their descriptive literature.

(Continued on page 169)



Wysong No. 1010, capacity 10 gauge mild steel, cutting length 10 feet.

Greater Accuracy! Greater Production! Less Maintenance Costs!

Hi-tensile casting construction gives the necessary weight and mass to Wysong squaring shears. With a tensile strength of 35,000 to 40,000 P.S.I. hi-tensile casting construction can resist the shock and pounding a shear must take. The heavily ribbed table, knife-bar and end frames resist sag or deflection and *maintain accurate alignment*. Because hi-tensile castings absorb vibrations, Wysong shears run quieter and smoother.

Standard features of Wysong shears include:

- Automatic, compensating holddown. Each foot under individual tension. Compensates for varying thicknesses in metal and permits simultaneous shearing of different thicknesses.
- Ball bearing precision back gauge. Adjusts to .0078 (1/128th) inches.
- Time proven, trouble free, 9-jaw clutch with built in non-repeat unit.
- Straddle mounted gears, run in oil.
- Metal finger guard, mounted on holddown. Does not obstruct view of cutting line.

Wysong shears can be equipped with power operated back gauge, a light gauge, remote control switch, automatic lubrication, extension gauges, and rubber pads for holddown feet. Rake of top blade can be changed for cutting plastics, composition sheets and special metals.

Wysong also builds air power and foot operated squaring shears and bending rolls. See your dealer or write to factory for full information.

Buy a Wysong... It's miles ahead.

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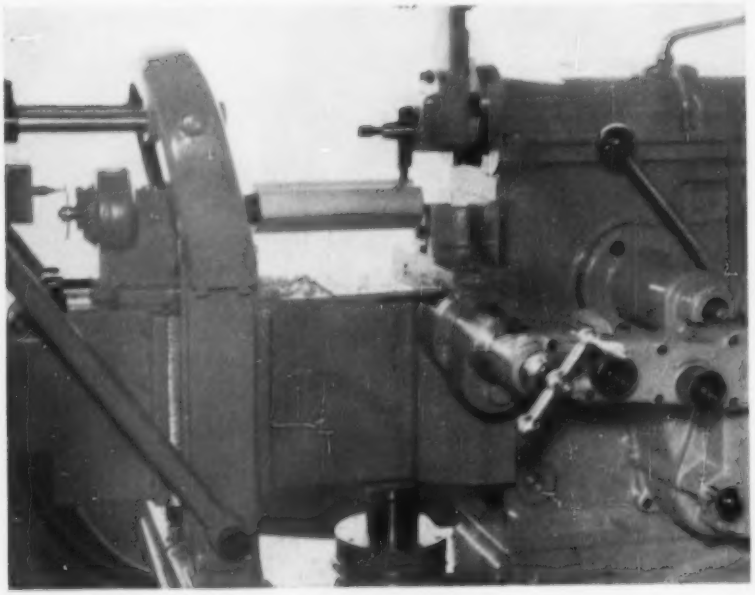


Haller Hydraulic Shaper Is Templet Controlled

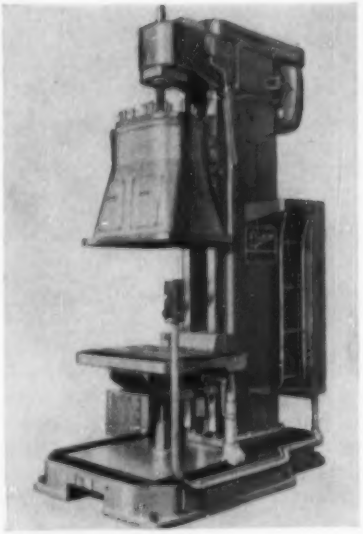
Hydraulic shaper for machining external contours is templet controlled for production of such parts as splines, contoured punches, contoured sections, and metal-removing electrodes or punches. Templet, made to same contour as part to be machined, is normally same size as work, although it can be made larger than work if desired.

In operation, templet is fixed on headstock and is engaged with a stylus or follower that actuates table through a hydraulic valve. Rotation of templet moves follower which controls the valve. This action positions table to conform to templet contour, and work, held between centers on table, is thereby positioned under the cutter on the reciprocating ram.

At beginning of job, first cut is made at lowest point on the templet, then cutter is applied until entire pattern is completed. For finishing, a specially ground cutter is employed with a nose radius equal to the follower radius for high accuracy. Special feed gear is provided for changing feed during operation to suit such work as steep curves where a reduced feed is recommended.

Ram stroke is 11 11/16 in., and maximum work length is 11 in. Largest dia piece that can be accommodated is 7 13/16 in. Strokes per min are 30, 60, 90, and 180.

Haller, Inc, 684 Ann Arbor Rd, Plymouth, Mich



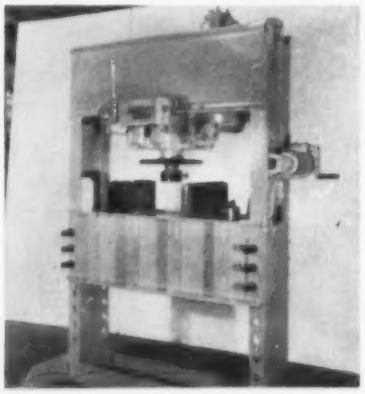
Buhr Vertical Drills Have Universal-Joint Drive

Standard vertical hydraulic-feed drilling machine line announced by Buhr includes three basic models. Line is built to JIC electrical and hydraulic standards, offering full use of horsepower of the spindle-drive motor, with a separate motor employed to drive the hydraulic power unit. Ways are of hardened and ground steel, and all moving parts are lubricated automatically.

Model VHU-12 (illustrated) has 12-in.-wide ways, 16-in. stroke, and 7½ hp. Model VHU-18 has 18-in. stroke and 15 hp; Model VHU-24 has 24-in. stroke and 20 hp.

Each model is built with a wide variety of head sizes and spindle-drive arrangements to accommodate widest use in medium- and heavy-duty operations. Wide range of spindle speeds is available through speed selector and pickoff gears in main gearbox. Each spindle drive is equipped with an independent high-and-low speed change. Infinite feed range and various cycling sequences are attained by hydraulic feed.

Buhr Machine Tool Co, Ann Arbor, Mich



Manley Hydraulic Press Develops 150-ton Pressure

Similar in design and construction to Manley 60- and 80-ton models, addition to company line is built for pressures up to 150 tons. Unit's hydraulic cylinder is of welded construction. Table-raising mechanism has been improved to provide more accurate control.

Upright members have side openings to permit long shafts to be placed on the table for straightening. Improved movable-head mechanism allows press heads to be moved longitudinally across the frame. Unit is equipped with locking devices and safety overload valve.

Manley Div, American Chain & Cable Co, Inc, 929 Connecticut Ave, Bridgeport 2, Conn

Retort basket is designed to eliminate danger of tools falling through grid while being processed in pit furnaces. Mesh openings for each Inconel grill are spaced differently to hold items of various sizes. Fixture carrier is 15½ in. in dia by 36 in. deep; grills are 11½ in. in dia.

Wiretex Manufacturing Co, 40 Mason St, Bridgeport 5, Conn

JUST TRY IT!

..ask for a sample bar of La Salle's revolutionary

NEW fatigue-proof STEEL BAR

..the bar that has HIGH STRENGTH without heat treating

Yes, La Salle invites you to test a sample bar of the remarkable new FATIGUE-PROOF. This amazing new material is its own best recommendation . . . as proven by the many original equipment manufacturers who have already tested (and are using) FATIGUE-PROOF.

If you are making parts requiring strengths in the tensile range of 140,000 to 150,000 psi, and want to eliminate the expense or problems of heat treating . . . if you want to save production costs with a bar that machines faster (25% faster than annealed alloys—50% to 100% faster than heat treated alloys) and gives you a beautiful finish, too . . . if you want to improve the quality of your product while saving money, send us a blueprint, drop us a note giving application details, or better yet . . . pick up your telephone and call a La Salle sales engineer (REgent 4-7800, Chicago, Illinois).

If it appears that FATIGUE-PROOF can help you improve your product and cut your cost, he will arrange to provide the necessary test sample at no expense to you.

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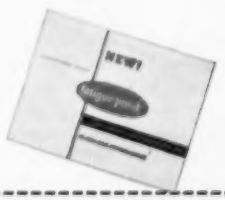

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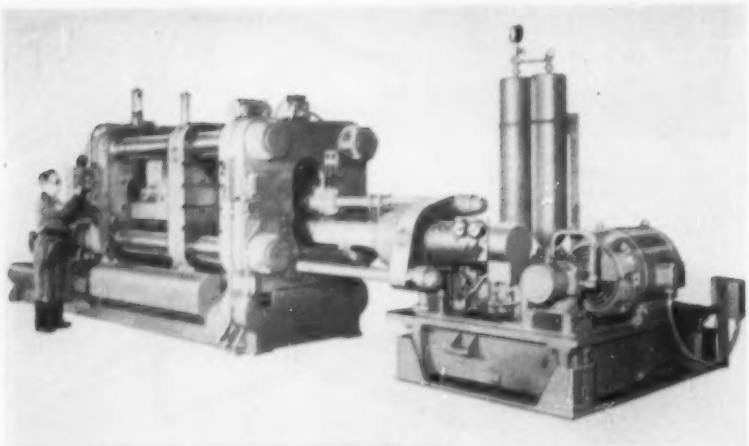


HPM Die-Casting Machine Produces Aluminum Parts

800-ton die-casting machine, capable of producing aluminum parts weighing up to 35 lb, is designed for manufacturing such parts as automotive grills, transmission housings, motor blocks, and outboard-motor castings.

Self - compensating mechanical link-wedge locks clamp to rated tonnage. No tierod nut adjustment is required, and pushbutton control provides central-screw daylight and tonnage adjustment. Unit is equipped with electric-hydraulic safety interlock.

Flexibility of operation is provided by control of strokes, slowdowns, and automatic cycling, including three core pull and ejector sequence. Die platens are 59 x 55 in. and variable die height (daylight) is from 34 to 16 in. Power input is 80 hp. Machine has 9-in. tierods and weighs approximately 81,000 lb.

Other features: positive pressure follow-through with no delay; special valves for control of distance-speed curve with injection plunger; flexible injection stroke for control of metal volume and variations in cover die thickness; manifolded high-pressure hydraulic elements.

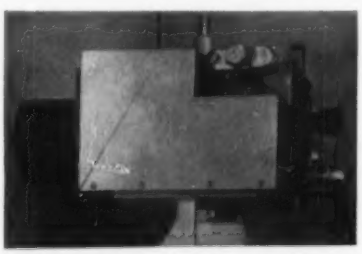
Hydraulic Press Mfg Co, Mt Gilead, Ohio

Straight-Side Automatic Presses

Line of high-speed presses from Precision Welder & Flexopress Corp feaures integral dual-roll feed, heavy-duty stress-relieved frames, double-throw crank, and anti-friction, bearing-mounted ram slide. High-speed characteristics are from 75 to 300 strokes per minute, and automatic operation is made possible through use of accurate roll feed and ball-bearing ram construction.

Model SS-75 was exhibited recently at the ASTE show in Chicago, is capable of producing automotive parts automatically from coil stock at the rate of approximately 150 parts per minute.

Precision Welder & Flexopress Corp, 3580 Ibsen Ave, Cincinnati 9, Ohio



Infrared Camera Takes Pictures In Total Darkness

Evaporagraph is designation for infrared camera manufactured by Baird Associates which can be used for a variety of operations, including detection of hot spots in machinery and study of heat distribution in furnaces and ovens. Device is also reported useful in checking operating temperature of electronic equipment where life is a function of temperature.

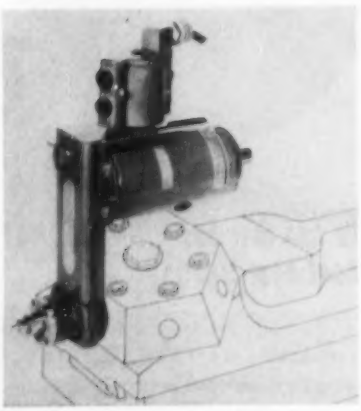
Operator can take picture in total darkness and see result on ground-glass screen or take a photograph. It is possible to work out a "heat pattern" like a contour map.

In operation, unit collects radiation emitted from an object and focuses it as an image onto an oil film coated on a membrane only 4 mu-in. thick. Oil then evaporates from point to point at rates varying with amount of radiation received at each point. Seen in reflected light, the differences in oil film thickness appear as different colors.

Instrument is so sensitive that it can detect differences of 1° F in a 15- to 30-sec exposure. Since different materials radiate varying intensities of infrared, depending upon temperature and surface, a detailed thermal picture of the field of view can be obtained in color. In effect, picture is equal to the application of 30,000 thermocouples.

Device utilizes no electronic circuitry, is housed in a cabinet 18 x 14 x 11 in. It may be rented or purchased for $9500.

Baird Associates, Inc, 33 University Rd, Cambridge 38, Mass



Drill Attachment for Small Turret Lathes

Model 25 "Speedy" drilling attachment is addition to Vilter line of Tru-Hole turret lathe attachments, and is designed for use on small turret lathes of the Hardinge-Rivett-South Bend class. Variable-speed motor is reported to allow drilling of holes as small as an 80 drill up to 5/32 in. in any material.

In operation drill and work turn in opposite directions, so that both axes tend to coincide, effecting close concentricity and reducing drill wandering.

Specifications: weight, 12 lb; speed adjustable from 1000 to 10,000 rpm; mounting shank diameter, ¾ or ⅝ in.; length from turret face to end of chuck, 3⅞ in.; motor, single-phase 110v 60 cycle.

E F Vilter Co, 4161 N Richards St, Milwaukee 12, Wis

NO MATTER HOW YOU USE OIL DE LAVAL KEEPS IT CLEANER, DRYER!

Clean, dry oil is essential in any operation.

And the best way to keep it clean and dry—is with De Laval Purifiers and Clarifiers . . . proved best in countless major plants all over the nation.

No matter how you use oil . . . for lubricating, machining, drawing, honing or many other operations in metal working . . . De Laval is the one answer to dry, clean oil.

Write for all the facts that can put more profits in your picture . . .

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THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

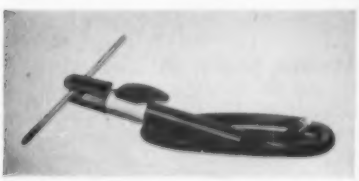
High-Speed Throatless Shear

Electrically powered throatless shear made by Beverly Shear Co is designed to cut any shape in metal up to 10-gage mild steel. Shear is complete with its own base and supporting column, which may be removed so that shear can be used as bench model.

Eccentrically mounted cutter head imparts a downward-forward motion to the upper blade, which shears work rather than punching through it.

Powered by 60-cycle, 120v ac motor which is directly connected to the cutter head, instrument produces 1725 cutting strokes per minute. Shear reportedly will slit 12-gage mild steel at rate of 15 fpm; lighter gages may be cut proportionately faster. High-carbon, high-chrome upper and lower blades are adjustable for wear and easily removable for replacement or resharpening.

Beverly Shear Mfg Co, 3004 W 111th St, Chicago, Ill

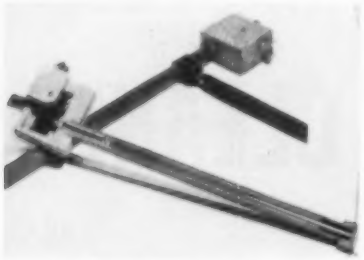


Cutting and Gouging Torch For Heavy-Duty Operations

Model G-5 Arcair torch has new, impact-resistant molded jaw insulators, and a silicone glass laminate sleeve to protect the upper end of the handle from heat. Unit will take up to ⅝-in.-dia electrodes, and reportedly delivers approximately twice as much air as the previous G-3 model.

The G-5, which operates from ordinary dc welding machine and compressed airline, has a rotating nozzle that permits changing electrode angle to suit the job, but always maintains air jet in perfect alignment. Air and current are brought to the torch through a concentric cable, permitting added flexibility and handling ease.

Arcair Co, 423 South Mt Pleasant St, Lancaster, Ohio



Plating Bath Temp Regulator Is Completely Corrosion-Proof

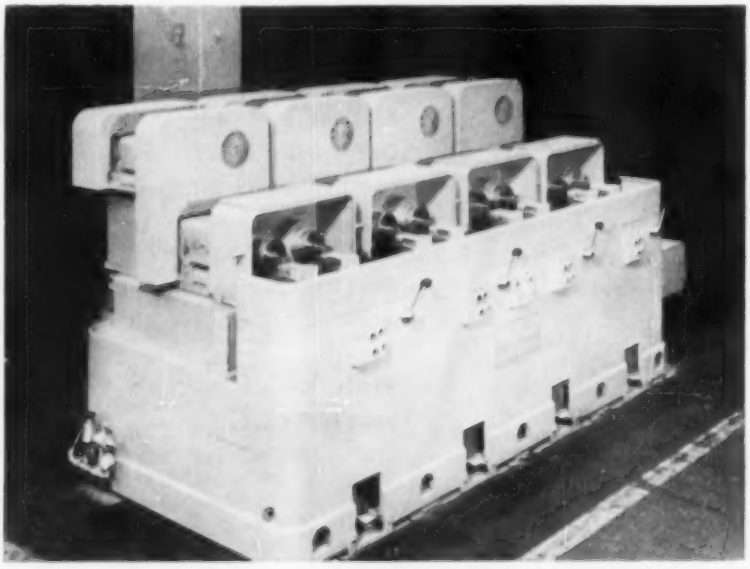
Entire body of the Eltemp is constructed of an acid-proof, temperature-sensitive thermoplastic called Uscolite. The expanding and contracting properties of this material, which, itself, is the thermal conducting medium, automatically regulate the operation of heating or cooling sources to a temperature tolerance of within plus or minus one degree in a constant solution level, reducing chance of boil-overs and resultant loss of plating concentrations.

Long thermal tube extends deep into the solution and compensates for temperature changes wherever they occur, providing a more accurate average-depth tank temperature.

Elkhart Controls Co, Route 2, Elkhart, Ind

Chemical milling of magnesium, made possible by process licensed by Turco Products and developed by that company in conjunction with Dow Chemical, is said to replace more conventional operations such as routing or milling. Process involves application of closely-controlled etching solutions to metals after areas that are not to be disturbed have been protected by masks.

Turco Products, Inc, 61st & S Central Ave, Los Angeles, Calif



REFRIGERATOR PARTS are machined on special Heald Model S Bore-Matic machine, which turns OD, faces rim, and chamfers 240 cast-iron parts per hour. Four-station, continuous-production unit has four hydraulically powered slide units mounted on scraped base pads, with each slide unit carrying two boring heads and a single motor-drive arrangement. Hydraulic pressure is supplied to slides by a 30-gpm power unit mounted at rear. Rotating air-operated, centrifugally damped workholding chucks mounted on boring head are interchangeable to accommodate different-size parts. Each of four stations is independently operated, two parts being machined simultaneously at each station—*Heald Machine Co, Worcester 6, Mass*

Chances are

98 out of 100

that this part

will be **perfect**

The Metal Parts Division, Sylvania Electric Products, Inc., keeps rejects under 2%—even on complex, close-tolerance parts produced at rates to 9,000 per hour. Optical gaging helps set this level.

The diode plate shown above is an example of the complex, mass-produced, parts turned out to close tolerances by Sylvania's Metal Parts Division at York, Pennsylvania. Tolerances run to ± .002"; as many as 10 dimensions must be held, including inner and outer diameters. Yet even on parts more difficult than this—parts with tolerances of .0005" and forming rates of 9,000 per hour—Sylvania gets an acceptance rate of over 98%.

Inspection on Kodak Contour Projectors helps Sylvania do the job to the satisfaction of its customers, both internal and external. Operators check the first parts produced by every machine to assure correct setup. Then, throughout the run, production samples are checked at regular intervals—making certain each machine is holding to tolerance. The speed with which these parts can be checked using optical gaging methods has helped slash rejection rates more than 50% since Kodak Contour Projectors were installed.

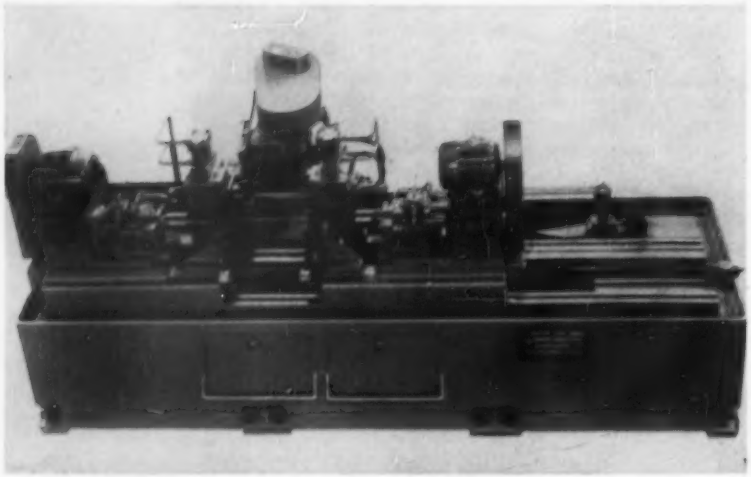
If you have difficult inspection problems involving quantity, speed, close tolerances or hard-to-measure dimensions like shoulders, holes, radii or angles, there's every reason to expect a solution by optical gaging on a Kodak Contour Projector. There's a representative in your area who can tell you more. To get in touch with him, or for a copy of the booklet, "Projection Gaging with Kodak Contour Projectors," write Special Products Sales Division.

Little training is required to operate a Kodak Contour Projector. Operators sit comfortably in a fully lighted room. The work gets out in a hurry.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak



M & M Machine Combines Cutoff And Double-End Operations

Model 00-T-C transfer machine is arranged to provide automatic feed of bar stock to a circular cutoff station, then transfer of work to two opposed secondary machining heads. Two basic machine sizes give capacity of ¼ to 1½-in. and 1 to 4-in.-diameter tubing or solid stock.

Stock is fed to stock stop set for a predetermined length; it is retained in a vise during cutoff operation and also in two transfer carriers. Transfer mechanism consists of two continuous chains to which carriers are fastened. After cutoff, work is indexed forward to double-end machining station. At this point work is positioned for endwise location by hardened shoes and lifted from carrier by self-centering, self-equalizing clamps and held during the machining operations. On completion of machining, work is lowered to carriers and indexed forward to the discharge position.

Stock stop, one chain carrier, vise, and one secondary machining head are contained on a saddle which permits quick adjustment for lengths from 5 to 60 in. Cutoff is performed by M & M triple-chip circular-saw method.

Heads can be equipped for centering, chamfering, turning, drilling, or boring. Box-mill turning can be combined with center drilling and chamfering.

Hydraulic and electrical equipment conform to JIC standards. Magazine-stock loading can be furnished.

Motch & Merryweather Machinery Co, 888 E 70th St, Cleveland 3, Ohio

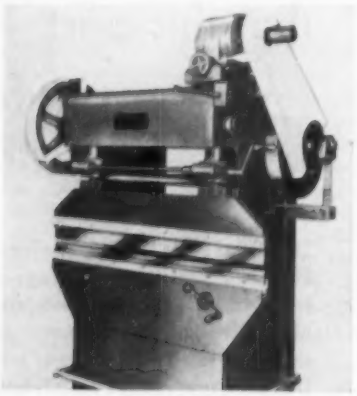
Hannah Four-Way Optical Square Simplifies Jig Construction

Four-way optical square is contained in a sphere, mounted on a spherical mount, and readily located by inside micrometer measurement. Using device, operator at a telescope can locate four points at the same time in the same plane normal to the basic line of sight, with all four points in lines normal to each other. A target in any of the four directions can be viewed by changing focus of the telescope to the distance away of the target.

Instrument can be adapted to any system of optical tooling, either as an integral part of the system or as a check on settings made with other instruments. Device is reportedly especially helpful in construction of jigs, where there is danger of accumulations of tolerance and stresses, and magnifications of error by projection of angles. Maker states that setting on optical square can be made separately to within 5 sec of arc.

Clinometer can be used to set square to any angle other than 90° from vertical and horizontal; transit is not needed to locate auxiliary lines of sight.

Elwon S Hannah, 6635 Goodwin, Linda Vista, Calif



Steuck Press Brake Has 24-ton Capacity

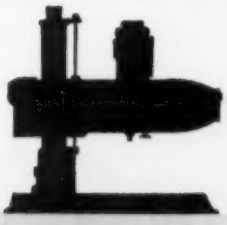
Connecticut Model 24-A-412 press brake is said to bend 4 ft of 12-gage mild steel over a ⅞-in. die. Features of 24-ton-capacity unit include all-steel gearing, front-operated variable-speed drive, 1-hp motor, and front-operated back gage.

Bed and ram are 48 in. long and distance between side frames is 32 in. Stroke is 2 in., and adjustment of ram by means of enclosed, worm-geared pitmans is 1½ in. Die space over bed is 7½ in. with stroke down and adjustment up, and gap is 6 in. deep.

W Whitney Steuck, Inc, Old Saybrook, Conn

Electric-arc etching attachment for engraving machines eliminates use of acids, simplifies marking of rounded surfaces and irregular contours, and makes possible the marking of extremely hard surfaces. Unit consists of transformer and etching spindle, and is offered to owners of New Hermes portable Engravographs at $49.50. Maker states that unit is ideal for marking highly stressed parts which cannot be stamped or engraved.

New Hermes Engraving Machine Corp, 13-19 University Place, New York 3, NY



NEW HEAD CONTROLS make Fosmatic Radial easier than ever to run!

Numerical Dials select feeds and speeds quickly, easily, with minimum possibility of error. Select even while drill is running, to save time on next operation.

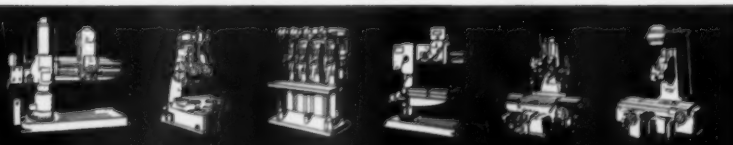
Single Control Lever starts, stops, reverses and shifts to feed and speed set on numerical dials.

Push Buttons on quick return levers engage feed. Feed is disengaged automatically by depth control or by pushing either button again. Magnetic clutch needs no adjustment.

Head Traverse Lever also elevates arm. Variable speed hydraulic motors drive both traverse screw and elevating nut. Clutches eliminated.

Other Fosmatic features include: 36 spindle speeds, 18 feeds, 4' to 8' arms, 13" to 19" columns, Boring Type Spindle, Safety Interlocks, Variable-Tension Counterbalance for Spindle, and optional Milling Feed.

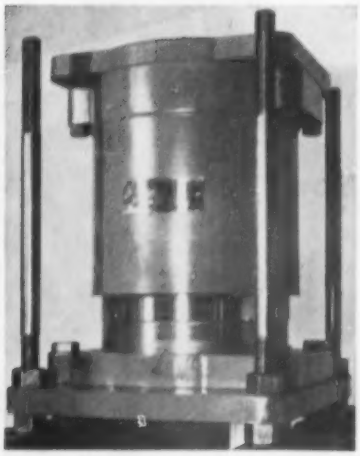
NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK



Pneumatic Die Cushion Comes in 12 Sizes

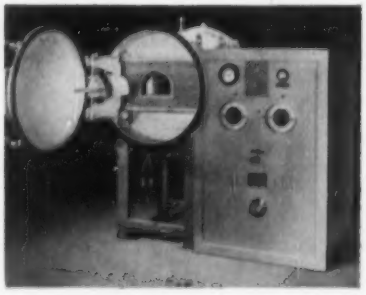
Dayton Rogers Model HD pneumatic die cushion of high-pressure type is built in 12 sizes, from 10 to 24 in. All-steel unit can be applied to the average punch press in either bolster-plate or press-bed mounting.

Unit is furnished complete with combination reducing regulating valve and pressure gage having shell-drawing capacity of from ½ to 12 in. and developing ring-holding pressure of from ½ to 14½ tons.

Die cushion is so designed that it will compensate for off-center loading of the hardened and ground pin pressure pad. Correct height of pin pressure pad is maintained by an adjustable nut, making it unnecessary to correct pressure pad for length of pressure pin.

One-shot centralized lubrication system is included, as well as bronze overlay on all-steel piston for maximum wear.

Dayton Rogers Mfg Co, Minneapolis 7, Minn



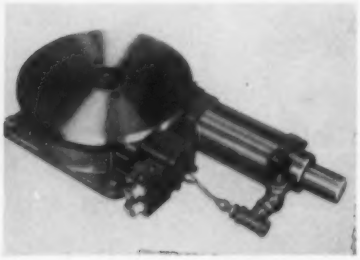
High-Temp Vacuum Furnace For Small-Lot Production

Designed as research or small-production furnace, Harper unit heats ceramic and metallic parts in a vacuum of 200 to 300 microns at temperatures up to 2500 F. Furnace has a D-shaped muffle with a chamber 7½ in. wide, 13 in. deep, and 5 in. high. Heat is produced by resistance heating elements placed around the muffle.

Unit is reportedly able to obtain a high vacuum in a few minutes for firing material to be placed in a hot furnace and heated under a vacuum. Use of removable end bell and hinged-plug refractory door provides ease of access to furnace.

Furnaces are available in larger sizes and with modifications for lower and higher temperatures for various processes.

Harper Electric Furnace Corp, Buffalo, NY



Accro-Dex Table Equipped For Automatic Indexing

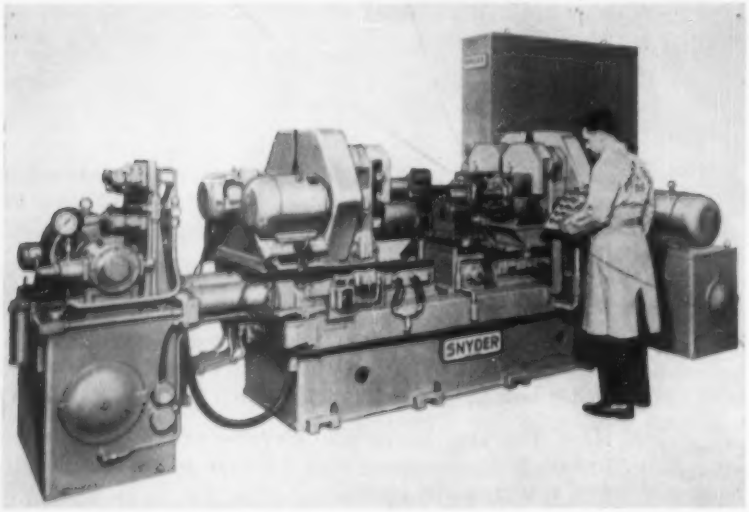
Built-in automatic switch actuators are an optional feature in air-powered rotary index table announced by General Automation Products Co. Actuating rods control main work operation, positive locking of table, and related movements such as work-holding devices and feeders.

Table has 12-in. diameter; ¾-in.-thick steel top is supported by a wide, lubricated peripheral bearing near the edge. Without disturbing table top, unit can be set to provide 4, 6, 8, 12, or 24 stations, and can operate at up to 150 index movements per minute at 24-station setting.

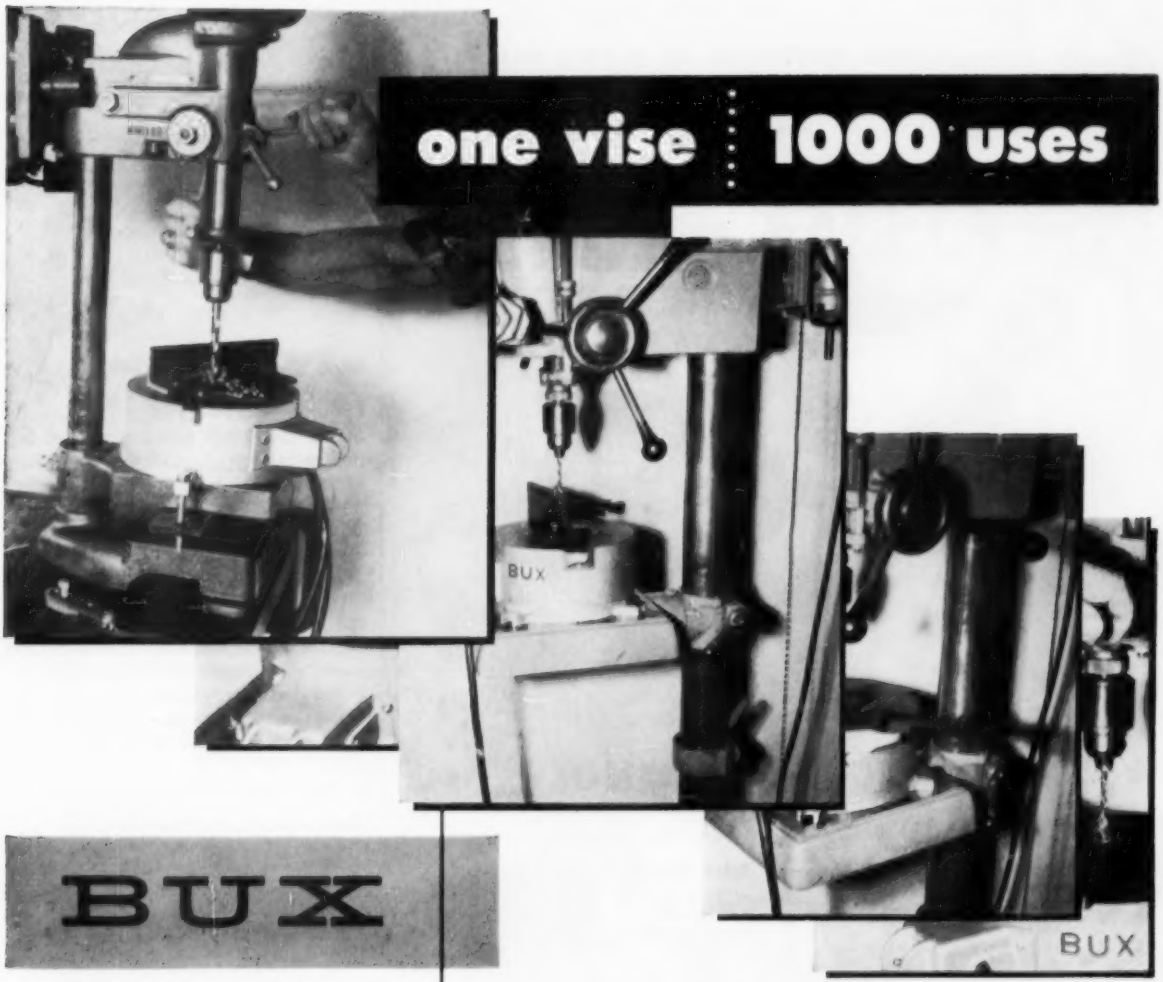
Loads up to 500 lb can be carried without jarring due to an adjustable air-cushion device at the head of the index cylinder. Index-cylinder piston seats against cylinder head at completion of any index movement, eliminating over-ride or skipping of stations. Locking wedge actuated by a separate air cylinder provides positive repetitive stops within 0.002 in. A ⅝-in. access hole is provided in center post to permit passage of piping or wiring to the table.

Hydraulic-powered models are also available.

General Automation Products Co, PO Box 14, Birmingham, Mich



CAST-IRON TRANSMISSION CASES are machined on Snyder 8-spindle, two-way precision boring machine, which finishes 19 different semi-mass-produced parts with a variety of bore sizes and center distances. Machine has two fixtures that enable boring of up to four holes at each fixture location and production of a finished part with each machine cycle. Each 2-spindle boring head is a separate slide unit and can be operated manually, automatically, and in combination with other heads. Electrically operated and hydraulically controlled unit produces finished part in 50 sec, occupies floor space of 5 x 15 ft—*Snyder Tool & Engineering Co, 3400 E Lafayette Ave, Detroit 7, Mich



BUX magnetic vise

BUX magnetic vise $235 list.*

A flip of a switch can now make a drill meet almost any drilling need. The flip of a switch on the revolutionary BUX **magnetic** vise. BUX holds your job in the unwavering jaws of a tremendously powerful magnetic field.

For production drilling, the two locating arms adjust just once, and are then held in perfect position for the duration of the run. How easily this is done, how easily and how certainly BUX can cut hours upon hours from your production time is a story too valuable to miss. Get it from your BUX dealer. Today is none too soon. Call him now, or send the coupon for fully descriptive information. BUX magnetic products also include portable magnetic drill presses adaptable to ANY standard portable drill, and portable magnetic plate clamps for use in welding heavy steel plates.

*Prices subject to change without notice.

Get full details TODAY

Mail this coupon →

BUX magnetic products—made by Buck Mfg. Co., 108 Roberts Road, Los Gatos 8, California.

Please send us complete literature about the new BUX magnetic drill vise along with the name of our BUX dealer.

NAME_____

ADDRESS_____

CITY_____

for { —greater confidence in gaging results
—continuous uniformity of production
—lower gage costs per piece inspected

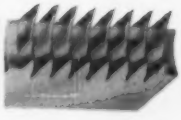
get **BESLY METRO GAGES**

Quality-Built to

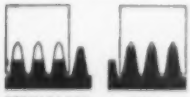
STAY ACCURATE LONGER

Micro-Lapped Finish
keeps gages accurate longer by reducing wear. No sharp "hills" and "valleys" to wear quickly and reduce gage accuracy.

Extra Clearance
at root of ring gages permits wear correction.



Truncated Thread Form



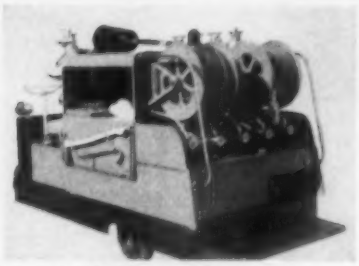
of thread plug at no extra cost. Enables accurate setting and permits easy check for gage wear.

Convolution of First Full Thread
on thread plug and ring gages removes sharp scoring edges and prevents chipping. Also makes Besly-Metro Gages easier to use.

Stress-Relieved
during manufacture by "deep-freezing" to normalize and relieve stresses and strains.

Lapped and Inspected at 68° F.
in air conditioned room which duplicates Bureau of Standards requirements.

BESLY-WELLES CORPORATION
Established as Charles H. Besly & Co. in 1875
120 Dearborn Avenue • South Beloit, Illinois



Seco In-Plant Fire Truck For Industrial Use

Model S-556 fire truck, designed for use in industrial plants, carries carbon dioxide, dry chemicals, water, and foam. Truck has speed of 15 mph, turning radius of 96 in., and is 50 in. wide and 68 in. high.

15-cu-ft accessory cabinet is included as well as a ladder cabinet for extension ladder. 100-ft hoses for water fog and carbon dioxide are standard equipment.

Catalog is available.

Seco Safety Products Co, 1300 W Fort St, Detroit 26, Mich

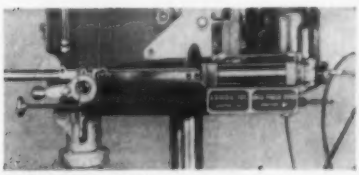
Portable Dust-Collecting Unit

Dustman, a self-contained dust-collecting and shop-cleaning unit, utilizes any standard trash or ash can as its waste receptacle. Attached to any metalworking machine, it picks up chips or shavings through a standard hood and 2½-in.-dia hose.

Suction is created by an 8-in. pressure-type blower; waste is deposited in the can, and free air escapes through a filter bag located on top of machine. Unit, powered by a 1/3-hp motor, will operate on any 110/120-v ac, single-phase system. Flexible hose is 6 ft long. Model, less can, is priced at $89.50.

Craftools, Inc, 401 Broadway, New York 13, NY

RELATIONSHIP GAGE for automotive differential carriers is said to eliminate need for separate setup gages for each station on production transfer machines. Gage is first checked for accuracy with master workholding fixture and working-master differential carrier, then located and clamped on machine, where it will indicate any misalignment in subsequent carrier production. Gage reportedly is so designed that any station causing trouble can be located immediately—
LaSalle Tool Inc, 3840 E Outer Drive, Detroit 34, Mich



Drillpress Feed

Heavy-duty drillpress feed, designed to be attached to any drillpress, milling machine, or other tool where controlled power is required to rotate a driveshaft, converts hand operations and controls to semi- or completely automatic.

Power plant is a Lehigh reciprocating air motor, or air cylinder, with built-in control valve. Air motor operates from shop air pressure to drive a rack and pinion, lowering or retracting the quill assembly automatically at preselected speeds. Out, or power, stroke is the outward stroke of the air cylinder, and is hydraulically checked at a preset point to give controlled speed of stroke and to lessen drill breakage at the break-through point.

Built-in impulse switch permits electrical sequencing with other equipment, such as rotary tables.

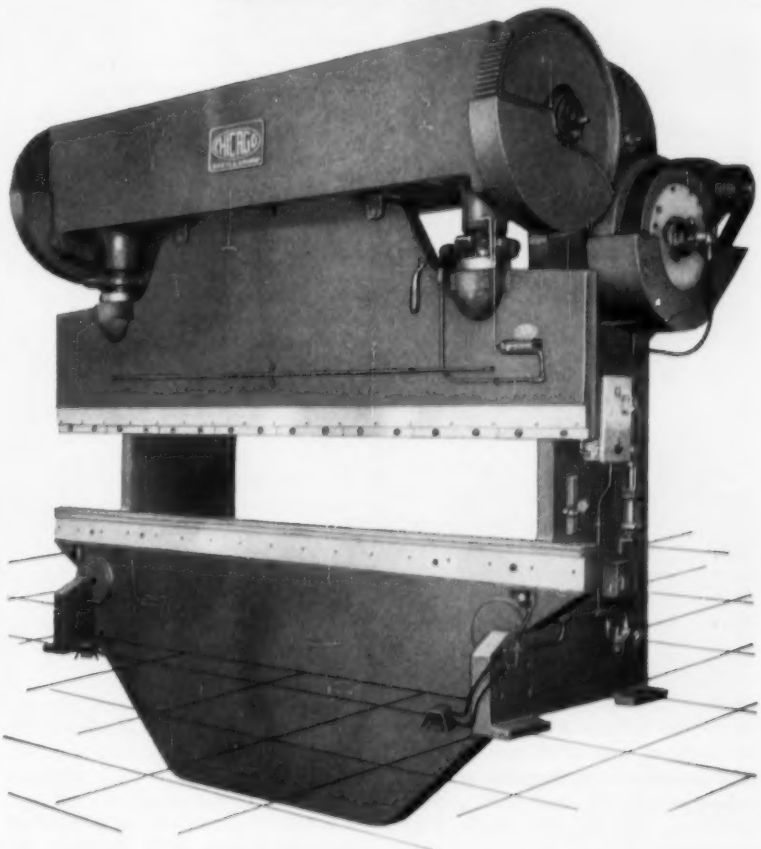
Current models utilize Lehigh 2- or 3-in.-bore air motors and provide 360° shaft rotation with 3⅝-in. drillpress stroke.

Air Control Div, Lehigh, Inc, Easton, Penna

CHICAGO DREIS & KRUMP

Press Brakes

FOR BENDING · FORMING STEEL PLATES



The most modern design throughout with all the features for the fastest bending and forming of steel plates. Large variety of standard sizes and capacities. Also modified designs for special production work.

Complete Engineering Recommendations for Any Job on Request 6149

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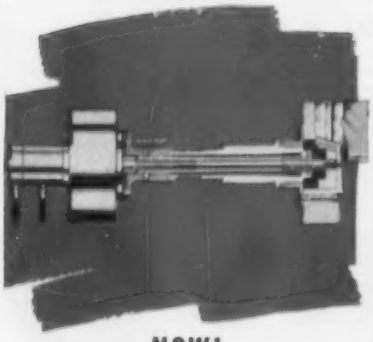
Press Brakes · Straight-Side Presses · Press Brake Dies

Hand and Power Brakes · Special Metal-Forming Machines

DREIS & KRUMP MANUFACTURING CO.

7434 South Loomis Boulevard, Chicago 36, Illinois

NEW SKINNER "JUNIOR" POWER CHUCKING UNIT



NOW!

Maximum production speed for your small lathes TOO!

This Skinner "Junior" unit can be adapted to almost any small lathe with 1" to 1⅜" hole through the spindle. It is light in weight, precisely balanced to minimize spindle bearing and braking loads, and provides extreme repetitive accuracy on internal and external work.

The Skinner 8" self-centering power chuck has gripping capacity from ¼" to 6". Its ¼" jaw travel exceeds the capacity of any collet, and is particularly valuable on production work where rough or finished holding diameters may vary beyond a single collet's ability to grip.

The Skinner "Junior" unit is complete. It contains chuck, 6" aluminum air cylinder, adapters, draw bar, etc.

Write Skinner or your nearest Skinner distributor for illustrated folder.

THE CREST SKINNER CHUCKS OF QUALITY

THE SKINNER CHUCK COMPANY

203 Edgewood Avenue, New Britain, Conn.

NEW SHOP EQUIPMENT

Control panel, Metco Type CP, for automatic metallizing, permits setting all gas, oxygen, and air controls and wire feed at one time. Operator controls spraying operations with turn of the handle.

Metallizing Engineering Co, Westbury, NY

V-belt pulley is equipped with built-in gear reductions ranging from 7:1 to 700:1 standard, and up to 8000:1 on special order. Unit consists of housing with V-belt grooves, a cover, a held gear, an output gear and two or four pinions, together with necessary bearings. Can also be adapted to gear or chain drive.

Hart Reduction Pulley Co, 426 W Main St, Waukesha, Wis

High-Speed, Low-Slag Electrode

General purpose electrode for mild steel welding, designated All-State Steelarc, is applicable with ac or dc welders. Low-amperage (40 to 225 amp) deposits exhibit tensile strength of 65-75,000 psi, a yield strength of 58-63,000 psi, and a 26-34% elongation in 2 in.

There is said to be no danger of burn-through, no slag removal between passes, a definite speeding up of downhand welding, and processing in cramped quarters. Steelarc is available in 3/32, 1/8, 5/32, and 3/16-in. core sizes.

All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY

Hard-facing material, Colmonoy No. 70, is designed to provide parts exposed to extreme conditions of vibration and/or heat with a wear-proof, corrosion-resistant surface. It is said to produce a surface whose hardness ranges from 50 to 55 R_c; specific gravity is 8.5; melting point, approximately 2000 F. Available as powder for application by Spray-welding, or as welding rod in 3/16, ¼, 5/16, and ⅜-in.-dia for application with oxy-acetylene torch flame. Also available as castings.

Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich

Large hexagon bars in C-1018 grade steel are available in sizes from 3 to 4 in. for production of large nuts, bolts, and other parts requiring this shape. Furnished in diameters of 3¼, 3½, 3¾, and 4 in.

La Salle Steel Co, PO Box 6800 A, Chicago, Ill

What TIMING RELAYS were most popular at the Chicago Machine Tool Show?

ALLEN-BRADLEY!
51.7% of all timers used were A-B

At the recent Chicago Machine Tool Show, more Allen-Bradley pneumatic timing relays were incorporated in the design of special control panels than all other makes combined —according to a survey of 849 machines. Furthermore, Allen-Bradley led in motor starters, relays, and disconnect switches, too!

Machinery manufacturers prefer Allen-Bradley motor controls because they are long lived . . . consistent in action . . . and above all else, trouble free in operation.

Bulletin 849 Pneumatic Timing Relay—the favorite of machine tool manufacturers because it is consistent and reliable in operation!

A-B Quality

Allen-Bradley Co.
1310 S. Second St.
Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

ALLEN-BRADLEY QUALITY

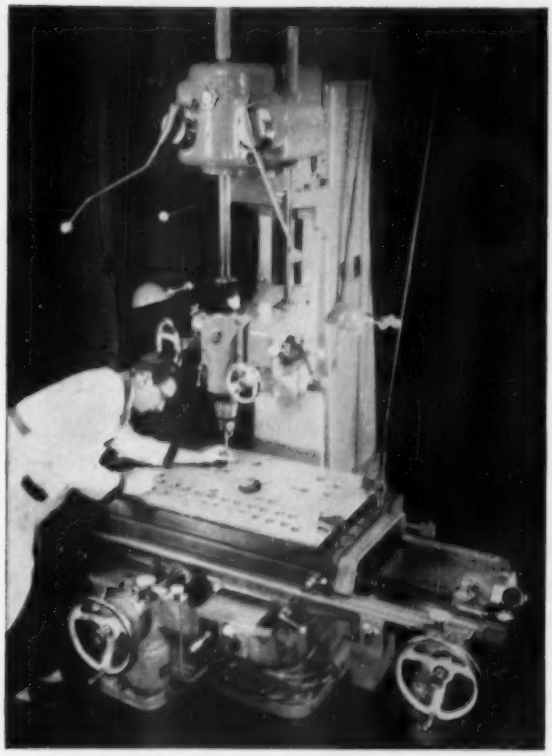
MOTOR CONTROL
The Preferred Line

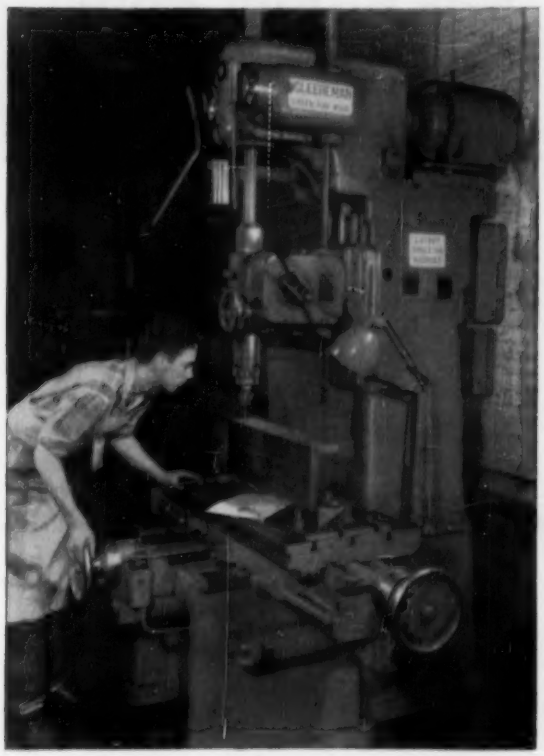
BUY Precision THAT FITS...!

for tenths
YOU NEED A
CLEEREMAN JIG BORER

OR

for .001"/foot
YOU NEED A
LAYOUT DRILLING MACHINE





If your work involves gages, jigs, fixtures, or "jigless" production with ultra-fine tolerances, one of the three models of Cleereman Jig Borers is the answer.

But when your work calls for tolerances of .001" per foot, the economy of the Layout Drilling Machine is the "common sense" approach to your problem.

There are installations near you. Your Cleereman distributor can answer your questions and arrange an inspection visit for you.

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CLEEREMAN MACHINE TOOL CORP.
GREEN BAY, WISCONSIN

For heavy duty precision drilling . . .

It's a

Jacobs

CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

Free Literature

To order any of these bulletins, please use cards at start of this section—page 152e.

MACHINES AND ATTACHMENTS

34 DEEP THROAT PRESSES—*Niagara Machine & Tool Works, Buffalo 11, NY.* 26-page bulletin 61C illustrates and describes new line of 22 to 150-ton capacity units with front-to-back crankshaft design and enclosed driving mechanism.

35 DIE-CASTING MACHINES—*Lester Phoenix, Inc, Cleveland, Ohio.* Illustrated brochure contains illustrated descriptions of line. Features, technical advantages covered; variety of installations pictured, typical parts which can be run on equipment discussed. Charts detail capacities for both zinc and aluminum die-casting machines.

36 TANDEM WIRE DRAWING MACHINES—*Waterbury Farrel Foundry & Machine Co, Waterbury, Conn.* 8-page circular 786-W-3 presents illustrated description of units including drum, block, and combination types for drawing brass, copper, aluminum, and other non-ferrous metals. Construction and maintenance features covered, as well as accessory equipment and spooling.

37 ROTARY TABLET MACHINES—*F J Stokes Machine Co, Philadelphia 20, Penna.* 6-page bulletin 650 gives data on Model 533 with max operating pressure of 10 tons, and Model 540 with 4-ton capacity. Design features illustrated; performance specifications and physical dimensions included.

38 DOUBLE-CRANK INCLINABLE PRESSES—*E W Bliss Co, Canton, Ohio.* 12-page catalog 3 contains illustrated information on enclosed models with box-type crowns. Specifications, features, dimensions included.

39 INVESTMENT CASTING—*Investment Casting Co, Springfield, NJ.* 11-page guide to advantages and applications illustrates and describes process. Enclosed data sheet covers shell molding.

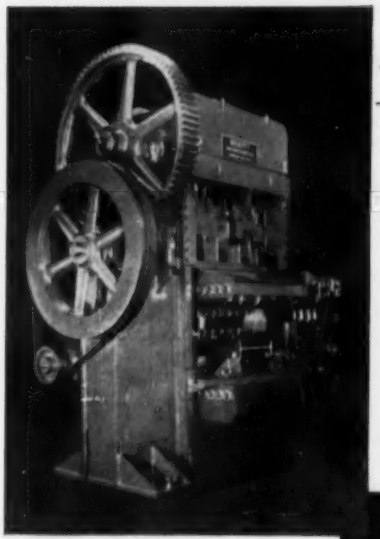
40 BORING & MILLING MACHINE—*Marac Machinery Corp, Yonkers, NY.* 12-page catalog describes features, characteristics of Schwartzkopff KBF2 with auomatic precision spindle positioning.

41 HYDRAULIC TESTING MACHINES—*Baldwin-Lima Hamilton Corp, Philadelphia 42, Penna.* 12-page illustrated bulletin describes units with capacities from 10,000 to 5,000,000 lb, including standard and special types of vertical and horizontal machines; incorporate hydraulic loading and independent hydraulic weighing system.

42 WIRE STRAIGHTENING & CUTTING MACHINES—*Lewis Machine Co, Cleveland 27, Ohio.* 16-page brochure M55-3 presents illustrated data on 19 models; new Mark I chamfering and deburring machine described, as well as single and double wire reels with Cam-Lok feature. Sizes, capacities, speeds charted for stationary cutoff and flying-shear cutoff units.

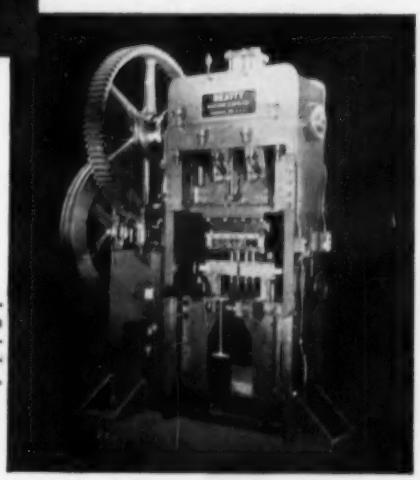
43 BENDING MACHINE, HYDRAULIC PRESS—*Paul Machine Tool & Die Works, Chicago 32, Ill.* Illustrated data sheet describes air-operated Bend-ex B-4 bench model automatic tube bender for up to 1500 bends per hr. Additional data sheet covers 4-column Hy-Power press with pressurized stroke.

44 METALWORKING MACHINES—*Famco Machine Co, Kenosha, Wis.* Illustrated general catalog includes specifi-



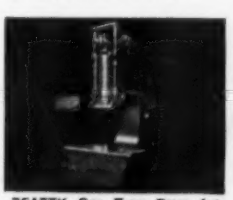
GUILLOTINE BEAM WEB PUNCH
Six individually controlled punching units with automatically synchronized punch and die, facilitate setting up to various gauge lines. 33" max. setting to outside units; 2⅜" min. setting between units. 200 ton cap.

GUILLOTINE BEAM FLANGE PUNCH
A turn of a handwheel changes punching centers and synchronizes punch with die. Four punching units, with 2¼" - 6¾" setting between inside and outside punches, adjustable 2¼" - 3½". 200 ton cap.

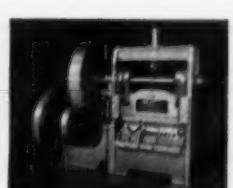


BEATTY Spacing Table handles web and flange punching without roll adjustment.

BEATTY Guillotine Beam Punch. Punches webs and flanges in "I" beams from 6 to 30 inches.



BEATTY Gap Type Press for forming, bending, flanging, pressing. 250 ton cap.



BEATTY Guillotine Bar Shear for angles, bars, rounds squares without changing tools.

FASTER

WEB and FLANGE PUNCHING

Beatty Built-in Adjustable Tools Save Set-up Time

REDUCE COSTS ON "SHORT-ORDER" PUNCHING

Take the high costs out of "short order" punching with these versatile BEATTY Guillotine Beam Punches. They're especially designed to reduce costs in handling short run web and flange punching where punching arrangements are frequently changed.

Incorporating entirely new time-saving *adjustable* tools that eliminate expensive setting up time, reduce down time . . . these BEATTY machines have lowered costs by as much as 75% on some metal fabricating jobs.

Dependable, accurate fast . . . BEATTY machines (standard models or custom-built to your specifications) can help solve your metal fabricating problems—reduce costs. Talk it over with a Beatty engineer!

BEATTY
MACHINE & MFG. CO.
HAMMOND, IND.

"BEST $1286 WE EVER SPENT!"

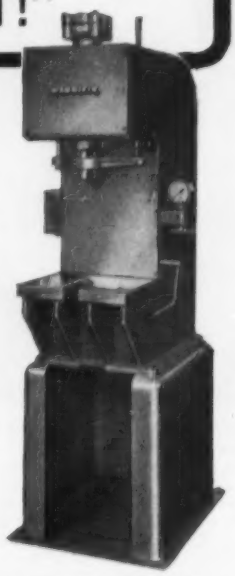
That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



HANNIFIN

Hannifin Corporation, 517 S. Wolf Road, Des Plaines, Illinois

Most Versatile

Ruthman

GUSHER Coolant Pumps

MODEL UL 7120

Popular Model proved in performance by many leading machine tool builders

Gusher Coolant Pumps are available in a wide variety of models to fit almost any requirement. You can choose from immersed, pipe connected, and flange mounted for external or internal discharge in either motor or belt driven types. Tank mounted models for portable use are also available.

This United States #1 Hand Milling Machine manufactured by U. S. Burke Machine Tool Co. is equipped with a Gusher Coolant Pump.

Ruthman centrifugal pumps are also available as circulators, agitators, molten metal pumps. Write us your requirements. We will be glad to furnish you further information.

THE RUTHMAN MACHINERY CO.

1818 Reading Road Cincinnati, Ohio

Free Literature

cations, descriptions, data on power, arbor, air, foot, and drillpresses; bandsaws; and squaring shears.

45 GRINDER—*William H Field Co, Boston 27, Mass.* 6-page folder M-55 describes new principle for sharpening small tools up to 3-in.-dia. Centra-Point method, featuring mechanical wheel dressing, self-registering tooth rests, and direct reading of clearance angles is illustrated; standard and optional equipment described.

46 HYDRAULIC METALWORKING PRESSES—*Elmes Engineering Div, American Steel Foundries, Cincinnati 29, Ohio.* 24-page bulletin 1010-C illustrates and describes complete line. Electric control provides semi-automatic operation, automatic, and inching. Speed change and reversal of slide governed either by ram travel or pressure.

47 HYDRAULIC PRESSES—*R D Wood Co, Philadelphia 5, Penna.* 4-page brochure gives illustrated information on units for bending, cogging, flanging, forging, forming, straightening, and upsetting operations.

48 GERMAN MACHINE TOOLS—*Henschel & Sohn GmbH, Kassel, Germany.* 20-page illustrated catalog describes special machine tools and standardized subassemblies for special and line production. Features and typical applications pictured; engineering data provided. 4-page illustrated folder contains illustrated data and specifications for gear shaping machine; external gears up to 17¾-in.-dia; internal gears up to 15¼ in.; max tooth width 3½ in.

49 OBI PUNCH PRESSES—*J L Lucas & Son, Inc, Bridgeport, Conn.* 12-page circular illustrates and describes line in sizes from 14 to 90 tons, and in 20 to 50 tons in straight-side high-speed type. Special features, equipment, and accessories covered.

50 CONTOUR BANDSAW—*DoAll Co, Des Plaines, Ill.* 10-page illustrated folder describes machining with use of Contour-matic band machine; based on ability to cut directly to a layout line, remove unwanted metal in whole sections, to process any contour, cutting continuously. Outlines machine's capabilities, discusses various parts now processed that had formerly to be machined with other methods.

51 HYDRAULIC C-FRAME PRESSES—*Elmes Engineering Div, American Steel Foundries, Cincinnati 29, Ohio.* Illustrated bulletin 1015 gives specifications and descriptions of line for forcing, straightening, bending, forming, etc.

52 HACK & BANDSAWS—*Capewell Manufacturing Co, Hartford, Conn.* Series of pocket-sized booklets "How to Use Hand Hack Saws," ". . . Power Hack Saws," ". . . Bandsaws," describes machines, operation, and maintenance; selection of blades and correct operational procedures; charts and diagrams included.

TOOLS AND ACCESSORIES

53 CHUCKING REAMERS—*Twentieth Century Mfg Co, Libertyville, Ill.* 8-page illustrated brochure 10-A lists Superream units in decimal sizes. Information for selection of styles, range of sizes and dimensions itemized with net prices.

54 INSERT HOLDERS—*Wesson Co, Ferndale 20, Mich.* 4-page bulletin 5510-M covers Multicut series for no-grind indexible carbide inserts with adjustable chip breaker clamps. Prices and specifications listed for 78 models. Typical applications, parts lists included.

55 ULTRASONIC TESTING—*Sperry Products, Inc, Danbury, Conn.* 8-page

Free Literature

bulletin 50-105 illustrates and describes application of Reflectoscope for non-destructive testing of products and equipment. Principle of ultrasonic inspection explained.

56 CHRONOMETRIC HAND TACHOMETER—*Herman H Sticht Co, New York 7, NY.* Illustrated data sheet 736 describes Jaquet Indicator, Catalog No. 2304-I, which reads directly in inches per minute. Instrument has guaranteed accuracy of ½ of 1%.

57 INDEXING TURNTABLES—*Eisler Engineering Co, Newark 3, NJ.* Catalog 88-56 and 88-56-C covers 150 types of indexing and rotating turntables and tables that can be set to practically any desired angle.

58 CLAMPING & HOLD - DOWN TOOLS—*Northwestern Tool & Engineering Co, Dayton 3, Ohio.* 4-page illustrated catalog 23, covers complete range for ⅝-in. bolt sizes up to and including 1-in. bolts. Includes prices and selection chart.

59 LUBRICATORS—*Bijur Lubricating Corp, Rochelle Park, NJ.* Instruction sheet illustrates and describes pull-type semi-automatic "One-Shot" units, Types HIB and JIB with 1-pt and 2-pt capacity, for machines requiring closely controlled but infrequent oil feed.

60 KNURL CUTTERS—*Alina Corp, New York 13, NY.* 6-page illustrated folder gives data on "Quick" cutters, capacities from 5/64 in. to 10 ft. Applications, specifications, features, ordering information included.

61 STANDARD ROUND HOLE DIES—*Adamas Carbide Corp, Kenilworth, NJ.* 4-page illustrated catalog D-855 (with price list insert) lists specifications and provides data on complete line.

62 MOLYKOTE LUBRICANTS—*The Alpha Molykote Corp, Stamford, Conn.* Bulletin 105 contains technical details on Type 165X, an open-gear lubricant, and LOEX, a lithium base product with temp range from −100 to +250 F. Test data and prices included.

63 PLASTIC DIES—*Marblette Corp, Long Island City 1, NY.* Collection of metal forming bulletins bound as a single booklet outlines manufacture, uses, and advantages of plastic draw dies, stretch press dies, and hydro-form dies. Contains data on selection of various tooling materials.

64 SOLID FILM LUBRICATION—*Electrofilm, Inc, North Hollywood, Calif.* Brochure B-3 describes advantages of process said to inhibit fretting corrosion, prevent galling and seizing, lubricates under high loads, high speeds, temps from −100 to +700 F. Can be used alone or in conjunction with oils and greases.

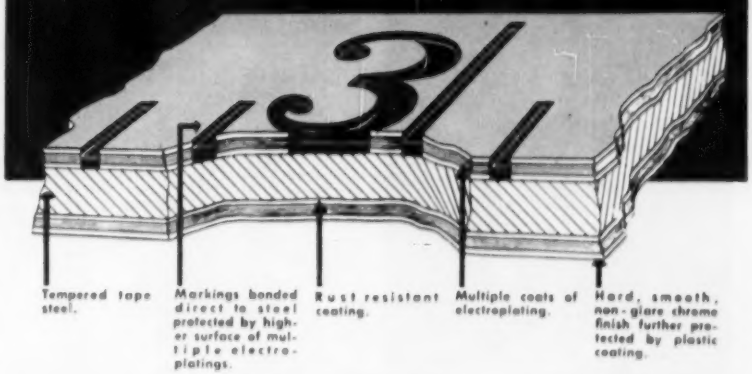
HEAT TREATING AND WELDING

65 ARC WELDING—*Ampco Metal, Inc, Milwaukee 46, Wis.* Bulletin W-17 contains data on welding with bronze electrodes, filler rods, and wire products. Sections describe Phos-Trode C, Mang-Trode, and Ampco-Trode 46 electrodes, welding techniques, processed, recommended currents, procedures, weldability chart.

66 GAS CARBURIZING—*Surface Combustion Corp, Toledo 1, Ohio.* 8-page illustrated bulletin SC-172 illustrates and describes furnace equipment for process. Features, advantages, engineering data included.

67 CO_2 SYSTEMS FOR INERT GAS WELDING—*Pure Carbonic Co, Div, Air Reduction Co, New York 17, NY.* 4-page illustrated catalog ADPC-26 contains

Why LUFKIN Chrome Clad Steel Tapes last longer


Tempered tape steel.
Markings bonded direct to steel protected by higher surface of multiple electroplatings.
Rust resistant coating.
Multiple coats of electroplating.
Hard, smooth, non-glare chrome finish further protected by plastic coating.

Chrome Clad tape lines — a Lufkin exclusive — won't crack, chip or peel and are rust and corrosion resistant. Their jet black markings are easy to read and won't wear off. For longer wear insist on Lufkin.

LUFKIN MEZURALL

Practical, compact tape rule. Self-adjusting end hook. 6, 8, 10, 12 foot lengths. Rugged metal case is heavily plated. D-shape for inside measuring.

LUFKIN LEADER

Long steel tape. Metal, rust-resistant case covered with durable maroon vinyl. 25, 50, 75 and 100 foot lengths. Choice of standard or folding hook ring.

BETTER MEASURE WITH LUFKIN

LUFKIN TAPES • RULES PRECISION TOOLS

THE LUFKIN RULE CO., Saginaw, Michigan

New York City Barrie, Ontario

SAVE COSTS

CONSULT YOUR INDUSTRIAL DISTRIBUTOR

- He cuts down your inventory investment in tools and parts.
- He cuts your purchasing costs by providing one source for thousands of items.

413

A YEAR AGO
nobody believed it!

GOULD & EBERHARDT
21" SHAPER
installed (without cement, bolts or screws) on AIR-LOC pads that prevent machine from "walking".

Now, over 3,000 presses, lathes, etc. are installed on Air-Loc

AIR-LOC is the *only* machinery mounting method that gives you all these advantages:

- You just sit the machine on AIR-LOC.
- You don't need cement, bolts or other fastening devices.
- You reduce transmitted machine noise and vibration up to 84%.
- You start machine right away—no waiting for cement to dry.
- You can re-use AIR-LOC because it is not cemented, does not "pad down".
- You can mount up to 72 tons per sq. ft. on AIR-LOC with absolute safety.

Every order shipped same day received.

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Clark, Cutler, McDermott Co.
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Please send the booklet describing patented AIR-LOC to:

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COMPANY
ADDRESS
CITY ZONE STATE

Free Literature

information on Pureco CO_2 supply systems for use in welding industry. Data covers gas flow obtained from each unit. Typical welding applications pictured.

68 LIQUID CHILLERS—*Acme Industries, Inc, Jackson, Mich.* 16-page catalog 220-B covers two series of Flow-Therm packaged liquid chillers: C Series, with compressor, capacities 20 through 175 tons; and R Series for remote compressor mounting, capacities 15 through 300 tons. Flexibility for air conditioning, heat pump, and industrial cooling applications discussed. Specifications, capacity tables, engineering data included.

69 HIGH-TEMPERATURE ELECTRIC FURNACES—*Auto Control Laboratories, Culver City, Calif.* Illustrated leaflet contains data on Series 100 Thermocal units operating up to 2300 F intermittent and 2200 F continuous temps. Dimensional and operational data, design features, advantages discussed.

ROUND TABLE Discussion

AND . . . THEY'RE OFF!!

Should baseball and similar pools be forbidden in the shop? Is this a harmless form of betting that should be overlooked by the foreman? Or will it mushroom into something that may be really serious?

THE DESIRE of the normal person is to take a chance. We do this because everything that comes naturally in life is a happenstance or chance. Our whole living, our social structure, is built up on the chance of success. So the taking of a bet or buying a pool ticket is little more than the desire to extend our chance-taking.

Now it is true that this is a form of gambling and is prohibited by state and federal laws as a general practice. Yet many societies, organizations, and some churches have held raffles and sold tickets on turkeys without so much as a murmur from anyone except the few who obtain their pleasure in life by always being on the opposite side of the fence.

However, when laws are written and passed by those who are responsible for the betterment of the community, and established by those responsible individuals who were elected to their offices by the majority of the people, the acts that these people put into force should and must be observed. The same is true in the company which has written into their policies and operating procedures of the organization the fact that gambling of any type is prohibited.

Workers must obey such rules or be subjected to the penalty. Many times however, such laws or rules are only sham, and even the directors and officers of the company break them. How, therefore, can they expect to enforce a ruling with an employee when the law is a basic part of the company policy?

Many people like to think of gambling as if it is divided into two classes. This naturally cannot be done, for the basic principle of gambling is taking a chance and there is no way to divide this. Nevertheless, people do think in terms of gambling for big stakes at professional gambling houses as a sin, but if the same thing is done at a poker game in the club, it is okay. The same is true about the baseball pools or the sweepstakes or the raffle on an automobile. These are all considered as "little things" and are often entered into for fun and should not be prohibited unless they become a habit which changes the social aspect of the individual. A very, very fine line . . . and one which is about as straight as a snake's back.

Actually, baseball pools are harmless in themselves as are raffles, but it is the constant combined effort which must be guarded against. Should Al step on his men? If Al knows that no one in the top management group is running a baseball pool, and that the company stands ready to back him up on his stand, and if the company rule is definite about its forms of gambling, then he certainly should stop the pool. That is, he will stop it by driving it underground or undercover where most of the pools are in every strict shop. And it is usually in this type of pool

"By the way, how much am I making these days?"

that the bets are not for penny ante either. Open pools are less dangerous than those operated under cover.

A foreman must carry out the rules of the company, but he must also see that the rules that he lives by are the same rules being used to run the rest of the organization. If they are not, then it is his responsibility to try to get the rules changed and properly written.

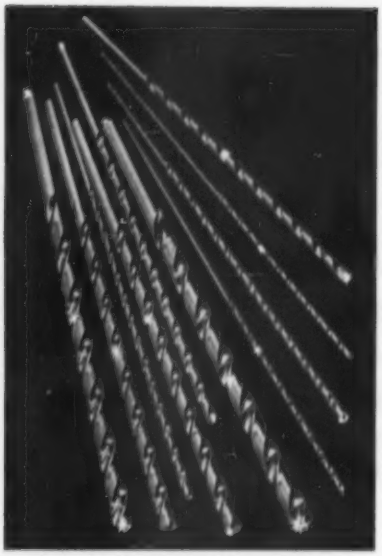
Charles D Townsend
West Hartford, Conn

MOST OF the gambling in the shop results not from any great desire to gamble but from the necessity for a diversion. In spite of all the industrial progress, the reduction of manual effort, and the advancements made to improve working conditions, the individual employee must still daily face the dreariness of labor and the loneliness of thought.

The young man in the shop has the enthusiasm which comes with ambition and hope. He can drive himself at his work for he is not working here in the present, he is working in the future. The men who have been working away for a number of years know full well where they are and where they are going. The need for foremen and supervisors is slight, and only a few can hope to attain that level. There is that group in the shop that constitutes the major portion of the working force, and they know that the chance of advancement for them is small indeed. For them each new day is not a new experience; absent is the exhilaration of discovery and the refreshing experience of learning. In their place is the monotonous repetition, dulling the senses and tiring the muscles. The ensuing fatigue is the result of physiological and psychological factors. The physiological factor is mostly muscular fatigue. The psychological portion is primarily the result of constant attention. Attention involves tension, so part of such psychological weariness is physiological at its base. Most psychological fatigue is an emotional response to a distasteful task. Doing something that you do not want to do is wearing. Make a task interesting and fatigue is not experienced.

In view of the existence of this problem of fatigue it behooves management to allow the men certain little liberties which do not interfere with production. In fact, some of these seemingly minor things may actually prove beneficial and result in an increased output. A little lunch-hour card game or a weekly baseball pool can become a popular

these are the reasons
BARNESDRIL
HONING TOOLS AND ABRASIVES
provide greater productive life — and lower stone costs!
Plugmatic Sizing
The Plugmatic Gauging Member directly sizes the bore being honed. Gauge is self-aligning and not affected by misalignment or eccentric stone wear. Bore-to-Bore accuracy is guaranteed within "tenths".
Electronic Feed Control
Electronic feed control operates automatically to maintain proper pressure between stone and work surface at all times. Adjusts automatically to compensate for stone wear, and keeps honing operation at peak efficiency.
"Extra Deep" Plas-T-Clad Stones
Patented BarnesdriL mounting provides up to 300% more usable stone life, with greater support closer to the cutting edge. Freer cutting action results, with longer abrasive life and less downtime for replacement. Quick-loading stone mount simplifies changing stones.
Shell Mounted
Clamp Type
Skirt Mounted
Extra Deep
Conventional
BarnesdriL
Write For Catalog 500G
BARNES DRILL CO.
830 CHESTNUT STREET • ROCKFORD, ILL.



Now! Drill deep holes without costly "Specials"!

ACE

12" LONGBOY DRILLS

If you've been investing a lot of money in "specials" for deep hole drilling operations, then here's good news for you! Ace Drill Distributors now carry, *in standard stock*, a complete line of 12" Longboy drills . . . ready for immediate delivery! And, in many instances, you'll find that an Ace Longboy can be a big *improvement* over a costly "special"! The polished flutes are precision ground into a properly hardened high speed steel bar. This makes possible a finer finish and keener cutting lips. And the result? Greater production, longer tool life, lower operating costs. Call your local distributor . . . or send for complete information today!

ACE DRILL CORPORATION
Adrian, Michigan

Gentlemen: Please send me your Catalog No. 52-A containing complete information on ACE "Ground-from-the-Solid" Drills and hardened H.S.S. drill blanks.

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COMPANY_____

ADDRESS_____

CITY_____ STATE_____

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

diversion. For a man to win a few dollars on the pool may seem unimportant to management, but it provides a topic for discussion and, even more, it provides material for thought. The men who lose can always look forward to the next week's pool. It is not a big deal, but it is always a thrill to win. No matter how often a man loses he does not give up hope, for he knows he has an equal chance. It gives him something to be a little enthusiastic about. It helps to relieve the monotony of the work and if management can see the true picture and realize its value they will not hesitate to allow gambling in the shop.

William Sinkowski
Woodside, NY

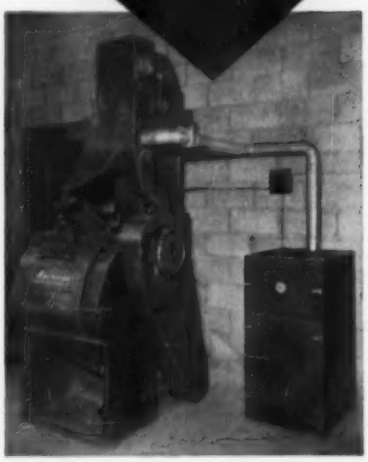
A little fun, now and then
Is relished by the wisest men.
But games of chance and betting pools
Are better left to knaves and fools.

THE SEEMINGLY innocuous baseball pool is still a form of gambling, and as such, should not be permitted in the plant. It should be a fixed shop rule that all forms of games of chance be strictly forbidden. Observance of discipline in the shop makes it mandatory that this potential work-disrupter be stopped before it can gain a foothold. Pools may be considered harmless fun outside the factory, but they carry trouble in their wake for the foreman or other executive who permits them in the shop. Failure of positive action on the part of the foreman will only be interpreted by the men as encouragement for further and more extensive betting operations.

Betting pools are definitely not harmless fun. While a rose by any

"Just for my own information—how could you have dropped anything On your foot?"

how to trap dust
that damages your machines and hurts company morale



easy-to-move
TORIT DUST COLLECTORS
trap dust at its source!

Untrapped dust costs you money, "secretly" forces precision machines out of line, limits production. Torit dust collectors are unitized for custom installation—save more money, usually more efficient than central (built-into-the-building) system. Torit unit operates only when machine or combination of machines it protects are in use. Filtered air may be returned to room to save heat. Many models and sizes, all self-contained, easy to move. Write today to...

TORIT MANUFACTURING COMPANY

Dept. 406
311 Walnut Street
St. Paul 2, Minn.

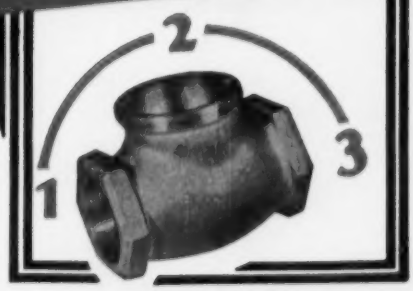
Sweet's

other name may smell just as sweet, gambling by any other name (such as baseball pools), smells just as malodorous. Where all forms of gambling in the the shop are prohibited by established shop rules, it will be easier to keep them from finding root in the shop. Disciplinary regulations covering infractions of the shop rules relative to establishing of lotteries or other forms of games of chance will nip such schemes in the bud and eliminate potential headaches for the foreman. It is hardly necessary to add that such rules should be strictly enforced, and offenders promptly punished.

Condoning a little bit of gambling in the shop on the grounds that it keeps the workers' sporting blood busy, and probably keeps them from getting into more dangerous trouble is fallacious. This delusive reasoning does not lessen the harmful effect of gambling on shop discipline. The most important purpose of shop discipline is simply increasing productive efficiency. To increase efficiency, managerial policy should be preventive as well as punitive, as applied to gambling. Hence, the alert foreman should attack disciplinary problems, such as gambling, in their incipient stages before they emerge as problems. However, where the foreman discovers gambling in the shop as an established fact, punitive action should be taken. It sometimes takes harsh methods to make certain workers recognize the reasonableness and propriety of disciplinary action taken for the good of the shop; nevertheless, it must be done.

Where gambling in the shop is first discovered, in violation of existing shop rules, being a disciplinary problem, it may be advisable for the foreman to handle it on a personal basis. The most frequently used device is the interview, and its purpose should always be to secure the agreement of the offender upon a future course of action that will increase cooperation. Where the worker persists in his betting activities after the first warning in the interview, then punitive action should be taken. It will be found that the average man caught in the illusive snare of making some easy money will see the error of his ways during the interview with his foreman. What is necessary therefore, is that the interview with the amateur gambler be so conducted that the offender is led to see, first, the reason for the shop rule, and, second, his own interest in its observation. Management must be represented not as a self-imposed dictator but merely as

ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

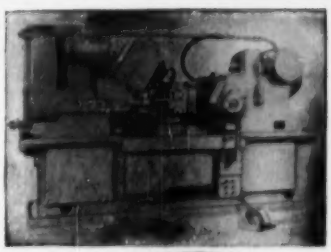


This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT QUANTITY

GOSS *and* DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

production begins with

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 50 years. Talk over your special problems with us. Absolutely no obligation. Write today.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

the enforcement agency, operating in the interest of all employees.

Toleration of a little "harmless" gambling in the shop can lead to quite a headache for the foreman who condones it. Minor infractions of shop rules, if permitted, may lead to a general tendency on the part of the workers to regard all controls imposed by management as unfair, improper, and unreasonable, and thereby tend to disrupt productive efficiency. Looking the other way when sporting pools are in operation is the surest way for the foreman to lose the respect of his men. Loss of authority is sure to follow. Being a good foreman is not just a matter of being a good guy, and condoning infractions of shop rules. You can't play with fire and not run the risk of getting burned.

Gambling in the shop is the bad seed of real trouble. When the foreman meekly propitiates the shop gamblers and glosses over his perplexity and weakness by excusing the offenders, he's cutting his authority out from under his own feet.

Harry Kaufman
Philadelphia, Penna

TIME-AND-HALF VACATION

If a man has missed a day's work because of illness, is it fair to expect him to work on Saturday for straight-time pay? Or should he be given regular time-and-a-half, despite his sick-day off?

A MAN'S VALUE to the company depends largely on his own general attitude. There are many employees who want to get ahead, but they are hard to find in the average shop.

I can recall many days in the past when I would have jumped at the chance to work Saturday to make up for a lost day through the week. Usually the fellow who will not work Saturday is the first one to gripe if he is not asked.

I recall during the war we had to share the overtime. We would start with top seniority and then down to last man on the list. We would then start at the top. Anyone who refused overtime more than once lost his turn and was not asked again until it reached his turn. We didn't ask any employee who refused more than twice. We soon found employees did not like to be left out of things, and showed a willingness to take their regular turn. An intelligent employee does the best he can at his particular job. This quality gives dignity to the job.

A E Salmons
Norristown, Pa

New Books . . .

GETTING AND HOLDING GOOD EMPLOYERS — *Published by Economic Research Dept, Chamber of Commerce of the United States, Washington 6, DC. 28 pages 6x9. Paper cover. Price 50¢.*

Yes, the word is employers, not employees. For here is a book that may be of vital importance to "city fathers" all over the country. If your community is not attracting new industries, or if the existing ones are moving away, or merely failing to expand, it is time to take a look at the "business climate" in your locality. Are restrictive labor policies holding you back? Is taxation equitable? How about your schools and recreational facilities? The effects of these and other factors are set forth in this instructive booklet.

But it is not all one-sided. There are certain obligations that business itself must fulfill. Employers, too, may read with profit to learn how they can, by their own actions and attitudes, improve the conditions that are engendering a bad business climate and thus restore their own industrial health.

•

MATERIALS HANDBOOK [EIGHTH EDITION]—*By George S Brady. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 1018 pages, 6x9 in. Price $11.*

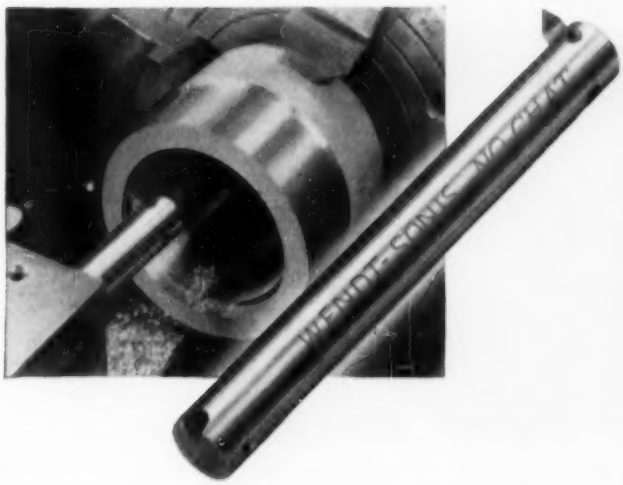
Addition of more than 1000 entries not included in the 7th Edition brings the total to about 10,000 materials. In addition, previous entries have been revised in many cases to include additional information or changes in designation. Spot checks of materials known to be new or recently changed were made by the reviewer. In each case the addition or change had been made, providing evidence that a thorough job of revision has been made in this edition.

The nature of the information provided on each material makes it useful as a general reference for purchasing agents and engineers. It generally includes chief characteristics, comparative data, sources, substitutes, and uses. When really detailed information is required on a material, you would expect to consult a specific text or handbook on that material or the firms that produce and supply it.

Part II of the book includes economic data relating to materials procurement.

WENDT-SONIS

*NO-CHAT SHANKS
reduce tool chatter



Wendt-Sonis NO-CHAT is a new alloy 75% more rigid than steel yet resistant to breakage from shock. On identical cuts tools with NO-CHAT shanks reduced chatter by as much as 50%. (Also, NO-CHAT and carbide have equal coefficients of expansion, so brazing stresses are eliminated.)

NO-CHAT shanks are re-usable. Brazing heat does not change the characteristics, as NO-CHAT will not anneal or harden.

NO-CHAT is an excellent shank material for boring bars and grinding quills as it reduces deflection which results in tapered holes.

Any type standard or special boring bar, quill or single point tool with NO-CHAT shanks are available. Fill out the coupon for new literature on Wendt-Sonis NO-CHAT.

**No-Chat is a registered trade name of the P. R. Mallory Co. Inc.*

WENDT-SONIS COMPANY
HANNIBAL, MISSOURI
ROGERS, ARKANSAS

WENDT-SONIS COMPANY
Dept. AMN-356, Hannibal, Missouri

Please send me new literature on Wendt-Sonis No-Chat.

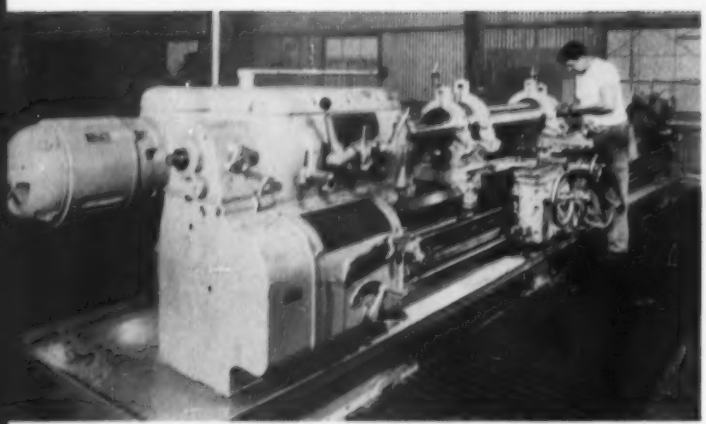
FIRM

NAME

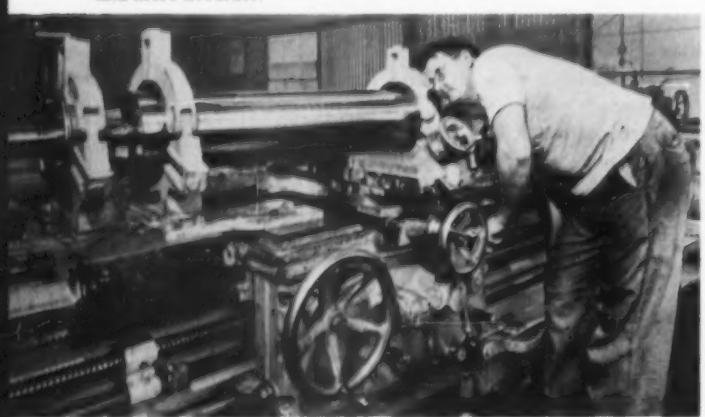
STREET CITY STATE

AXELSON production

AXELSON MANUFACTURING COMPANY



Turning, boring and threading on the Axelson lathes proved faster, easier and more accurate.



Floor to floor time of 1 hour and 40 minutes includes four cuts to bore I.D. from 6⅝" to 8".

Cylinders, shown in different stages of completion, are 10" O.D., 4' long, weigh 400 lbs. before machining. Finish to 30 micro-inches r.m.s. is required for hydraulic oil well driller to operate properly under punishing conditions.

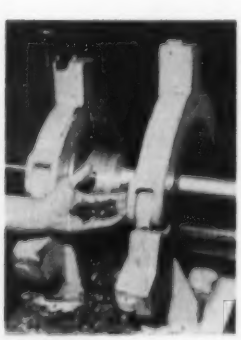
BORING TIME REDUCED FROM 2 DAYS TO LESS THAN 2 HOURS...

better surface finish, less taper, closer tolerance... on oil-well tool cylinders

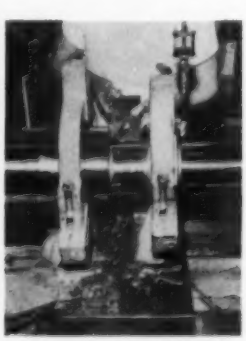
The Fluidrill, a hydraulic oil-well driller produced by Directo Corporation, Houston, operates at 100 to 20,000 feet underground, where it is subjected to brutal abuse from drilling muds, heat, rock and vibration. The component parts, and most particularly the heat-treated steel cylinder, must be machined to extremely close tolerance to function properly under these exacting conditions.

Accurate four-cut boring of this 400-pound, 10-inch O.D. cylinder was a task that had required up to two days to perform, until Axelson 20" and 25" lathes were installed to do the job! Floor-to-floor time is now 1 hour and 40 minutes; further advantages are: accuracy to 0.0015 over the 4-foot length, far better surface finish, and considerably less taper.

For a complete description and detailed specifications on Axelson Tool Room, Medium-Duty and the new 25/16 and 32" Heavy-Duty Lathes, write for bulletins A3-5507 and 5504.



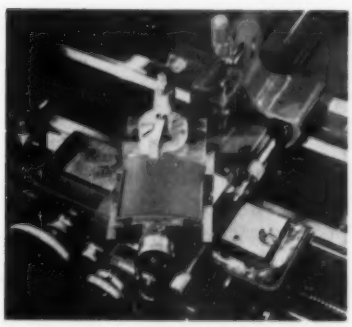
Metal chips shown are from 4142 steel cylinders. Cut is made at feed of 0.020, speed of 265 surface ft. per minute.



Carbide cutting tool being inserted into the bar. Cylinders are accurate to 0.0015" over 4' length.

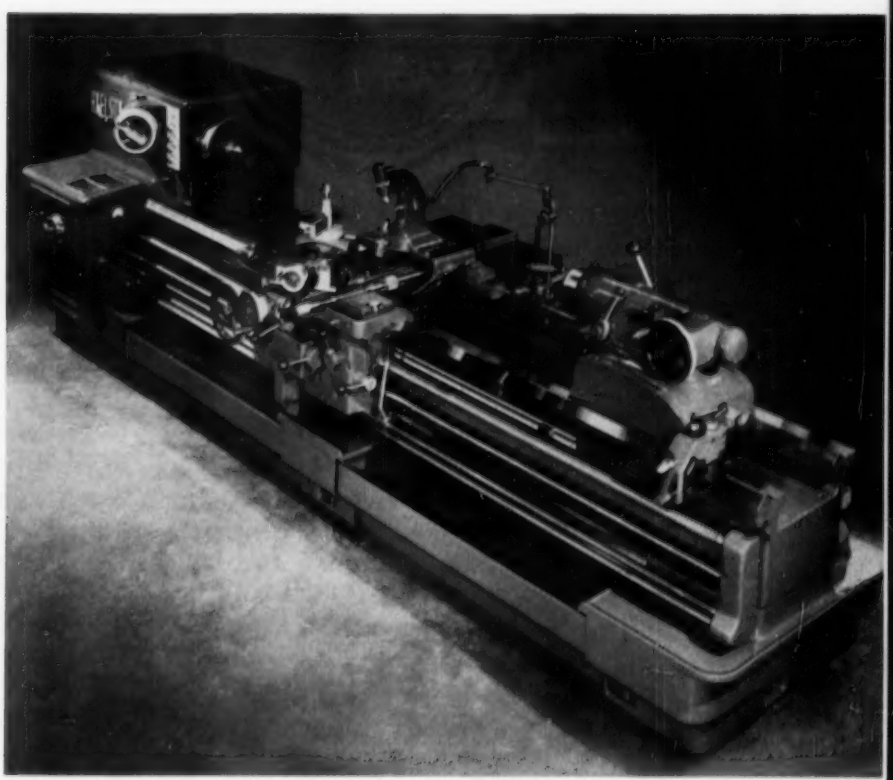
and maintenance news

DIVISION OF U. S. INDUSTRIES, INC. / 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA



Carriage and compound are designed for maximum operator convenience.

Two-speed tailstock provides fast traverse for setup work and slow spindle traverse for feeding tools held in center.



Easy controls make Axelson 25/16 lathe a flexible tool for tool room or production.

UNUSUAL FLEXIBILITY FEATURED IN 25/16 LATHE...

convenient controls simplify operation

Versatility and convenience characterize the new Axelson 25/16 Heavy-Duty Lathe, which is equally efficient for the tool room and for production. Forty horsepower is provided over range of 32 spindle speeds, from 11 to 1600 r.p.m. Speed changes are made through involute clutches. Preselective shifting is a standard feature.

The apron, of extra-heavy, box-type construction, is completely enclosed so that all shafts, gears and bearings run in a continuous oil bath supplied by a built-in pressurized oiling system. All operating controls, including longitudinal and cross-feed, rapid traverse, head stock preselective shifting, and lead screw reverse, are conveniently controlled from the apron.

Extreme rigidity and ruggedness have been designed into all component parts. The wide bed features an exceptionally heavy girth with thick longitudinal side ribs. Center and cross ribs of equal section provide heavy-duty strength and resistance to twisting.

AXELSON

Manufacturing Company

Division of U. S. Industries, Inc.

The Year Advertising Helped

IN 1954 we had a business recession in the United States. Sales fell about 4% during the year. If management had followed the historic pattern of business ups and downs, advertising volume would have fallen much further.

But in 1954 the volume of advertising did not fall. It increased over 5%. Every effort was made to stimulate sales when sales were needed to sustain prosperity.

This was something entirely new under the sun. It had a powerful influence in making the recession of 1953-54 one of the mildest on record. It helped greatly to speed business on to the record-breaking levels it has attained today.

There are several reasons why America's business management attacked this decline in sales with more advertising. One of them grew out of the greatly strengthened position of the American consuming market. Consumers' income after taxes has been rising an average of over $10 billion a year since 1946, and this rising income is more widely distributed than ever before. Furthermore, consumers have piled up reserves of about $215 billion in cash or its equivalent. These reserves offer a new and powerful inducement to increased selling and advertising effort even in the face of a possible decline in consumer income.

Taking the Longer View

However, the principal reason why a sales decline was attacked with increased advertising is management's new-found conviction that good advertising is essentially an investment in the development of a market. Successful development requires sustained investment. The inclination of business management to take this longer view, is, of course, motivated by the fact that the American market, with over 3 million consumers being added annually, is growing at a prodigious rate.

Ten years ago only a handful of companies had plans for investment in new producing facilities extending beyond the current year. Today almost all leading companies have investment programs running some years ahead. And keeping pace with these long-range business investment plans has been the development of sales and advertising programs to

Kill a Business Recession

reach tomorrow's greatly expanded markets.

This crucial role of advertising in providing driving power for our economy is gaining greater recognition every day. In his recent book, "People of Plenty," Professor David M. Potter of Yale University remarked: "Advertising is not badly needed in an economy of scarcity, because total demand is usually equal to or in excess of total supply, and every producer can normally sell as much as he produces. It is when potential supply outstrips demand—that is, when abundance prevails—that advertising begins to fulfill a really essential economic function."

Advertising's Key Role

Today abundance so completely prevails in the United States that it has been conservatively estimated that as much as a third of everything offered for sale falls in the realm of "optional consumption." That is, consumers can "take it or leave it" without any immediate personal inconvenience. But if they decide to "leave it," a terrific economic depression will not be far behind. In such circumstances, advertising—in which, in all of its forms, we are now investing about $9.2 billion annually—clearly is of crucial importance to our continued prosperity.

In performing its key role in past years, American advertising never realized its full potential. It successfully promoted sales. But it never was called upon to promote an overall economic stability as a direct outgrowth of increased sales.

By successfully promoting both sales and economic stability, as it did in 1954, advertising surely has added new strength to the American economy. It has also added a great new and constructive dimension to advertising itself. This accomplishment gave great significance to the celebration of the first National Advertising Week in February, 1956.

One of the surest means of expanding your sales volume in today's $150 billion *industrial* market is through dominant advertising in the publications directly serving your major customers and prospects.

McGraw-Hill's business and technical publications can give you quick access to the men who initiate, specify and approve the purchases of industrial products and services. Because all are leaders in their respective fields, you are assured a maximum return on your investment when you specify a McGraw-Hill publication to carry your advertising to your most important markets.

NEW
GREAVES
TOOLMAKERS OVERARM

Here's the way to add new "firepower" to toolroom milling operations! Install in your toolroom a GREAVES MILL equipped with this new Toolmakers Overarm.

You'll discover new versatility for milling intricate jig and fixture work, for keywaying, slotting and angular milling. Two graduated swivels permit mounting the spindle head in almost any angle for milling, drilling, spot facing and related operations.

Powered by an independent 2 HP motor, the unit is driven through helical gears. Eight speeds may be selected with convenient controls operating speed change clutches. A hand-fed quill attachment provides 4" tool travel to the spindle. Arbor support fits overarm, permits arbor type milling without changing overarm.

- Swivels permit any angular setting of spindle head.
- 2 HP independent motor drive.
- 8 speeds from 175 to 1750 RPM.
- Quill has 4" hand feed.
- Spindle equipped with No. 50 N. S. taper; reduced to No. 2 Morse taper when Quill Attachment is used.
- Gears run in oil bath.
- Full vision oil level gauge.

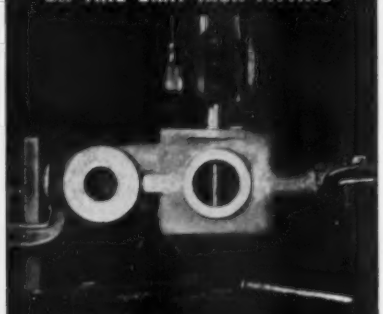
RACK FEED. The overarm is equipped with rack feed for positioning over work.

Write for Complete Specifications and Prices

GREAVES MACHINE TOOL DIVISION
J. A. FAY & EGAN COMPANY
2100 Eastern Avenue, Cincinnati 2, Ohio

Manufacturers of
GREAVES MILLS
"the MOST Mill for the LEAST Money!"

33% DECREASE IN DIE WEAR ON THIS GRAY IRON FITTING



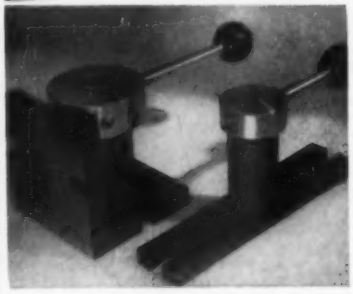
...thanks to
FERROCARBO®

Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE... because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

FOR FREE BOOKLET on FERROCARBO, citing actual case histories of faster machining, with longer tool life, write The Carborundum Company, Dept. 15, Niagara Falls, N.Y.

CARBORUNDUM®

ARROW 'QUICK LOK' COLLET VISE



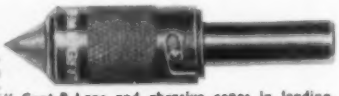
A Precision Production Holding Device

For drilling, tapping, milling, threading, reaming, etc., holding finished parts. Helpful on sub-assembly. Universally adaptable to drill presses, milling machines, surface grinders, etc. Made in 6 models, using 3C, 1A, 5C and 3AT Collets—capacity to 1", depending on Model. Prices range from $29.50 to $62.50. Write for further information and name of Tool Supplier. Several territories open for Suppliers.

ARROW MACHINISTS

17 N. WEST ST., MOUNT VERNON, NEW YORK

Abrasive Cent-R-Lap Tool



Saves time, eliminates diamond dressing. Cones changed in seconds. Available in 2 sizes, ½" and ¾" Cent-R-Laps and abrasive cones in leading grits. Write for descriptive literature and prices.

J. R. REICH MANUFACTURING CO.
45 E. Stroop Rd. Dayton 9, Ohio

SPEED SURFACE GRINDING SET-UPS WITH MAGNE-BLOX

LAMINATED PARALLELS AND V-BLOCKS

Save Your Magnetic Chucks
Eliminate Clamps
Eliminate Holding Devices

- Grind Work Square
- Grind Work Parallel
- Hold Round Pieces

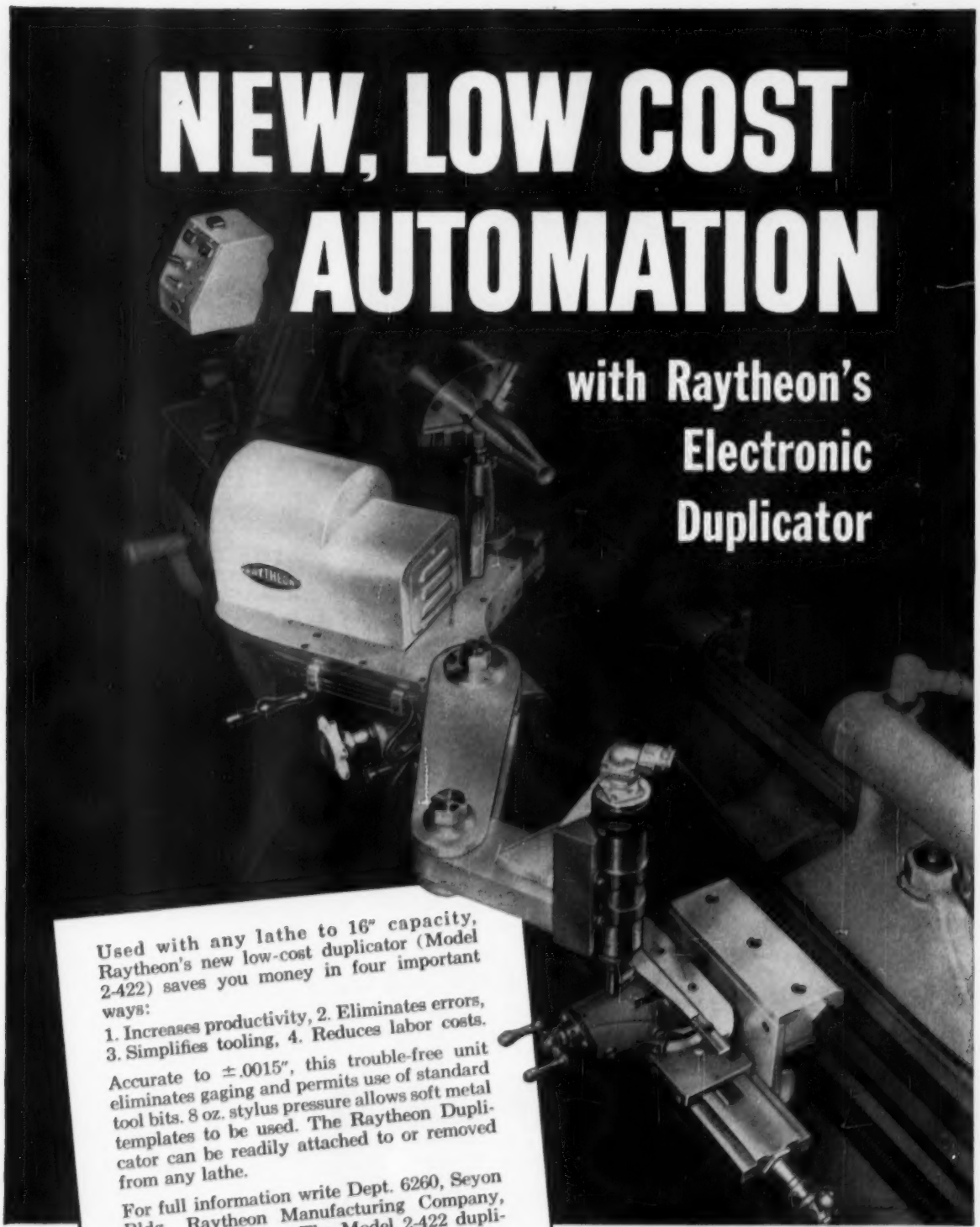
UNIVERSAL SET IN CASE $22.25

WRITE FOR ILLUSTRATED FOLDER

GEO. SCHERR CO., INC. 200AM LAFAYETTE STREET • NEW YORK 12, N. Y.

NEW, LOW COST AUTOMATION

with Raytheon's Electronic Duplicator



Used with any lathe to 16" capacity, Raytheon's new low-cost duplicator (Model 2-422) saves you money in four important ways:

1. Increases productivity, 2. Eliminates errors, 3. Simplifies tooling, 4. Reduces labor costs.

Accurate to ±.0015", this trouble-free unit eliminates gaging and permits use of standard tool bits. 8 oz. stylus pressure allows soft metal templates to be used. The Raytheon Duplicator can be readily attached to or removed from any lathe.

For full information write Dept. 6260, Seyon Bldg., Raytheon Manufacturing Company, Waltham 54, Mass. The Model 2-422 duplicator is also distributed by Voss Engineering Company, Pittsburgh 8, Pa.

RAYTHEON

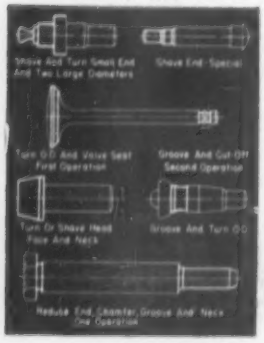
RAYTHEON MANUFACTURING COMPANY

Equipment Marketing Division, Waltham 54, Mass.

Excellence in Electronics

ECONOMY Automatic Shaving Machines
FOR LOW COST, FULLY AUTOMATIC—HIGH PRODUCTION

Typical parts machined on the "LS"-3600


Shave And Turn Small End And Two Large Diameters
Shave End Special
Turn O.D. And Valve Seat First Operation
Groove And Cut Off Second Operation
Turn Or Shave Head Face And Neck
Groove And Turn O.D.
Radius End, Chamfer, Groove And Neck One Operation

Illustrating operations completed on the S-4300

ECONOMY Automatic Shaving Machines are designed to perform facing, turning, grooving, necking, cut-off and burnishing operations on bolts, automotive valves, projectiles and similar parts.

They are available in two sizes—the "LS"-3600 for body diameters up to 1/2" and lengths under heads from 1/2" through 4-1/2"—the S-4300 for body diameters up to 1" and lengths 3/4" to 6" under heads. Production rates for the standard "LS"-3600 range from 800 to 2400 finished parts per hour and the S-4300 from 450 to 1800 per hour.

Machines are fully automatic and parts flow from hopper to work pan. Simple adjustments plus easy, rapid set-ups enable operator to operate several machines.

For the ultimate in accuracy, high production and low costs investigate ECONOMY Automatic Shaving Machines.

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Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
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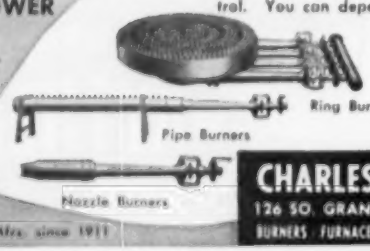

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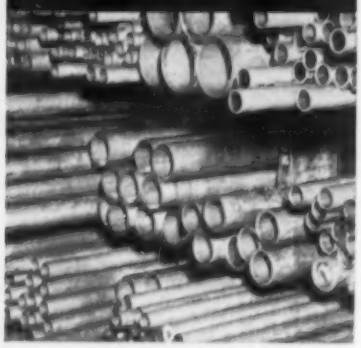

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BRASS

The traditional high limit of speed for resistance-weld tube mills heretofore has been considered 150 fpm. But recently, Yoder undertook the formidable task of more than doubling this speed for a certain customer. The Yoder team of engineers and research men took it in their stride. Before long a new mill was born—the first of its kind to successfully produce electric weld tubing at speeds up to 350 fpm, thus breaking all records for high production and low unit cost.

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Another and even more epoch-making achievement of Yoder engineers is the perfection of induction-weld mills for making non-ferrous tubing. Operating speeds approximate those of resistance-weld mills in making steel tubing. The resulting economies are especially great in making light and medium weight tubing in sizes up to 8" dia., from aluminum, copper, brass, monel, etc.

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The interesting details about these and other important new Yoder developments in tube manufacture are illustrated and described in the following publications, sent free on request.

- ☐ Resistance Weld Mills for Steel Tubing up to 4" diameter.
- ☐ Induction Weld Mills for Non-ferrous Tubing.
- ☐ Resistance Weld Pipe Mills for sizes up to 24" diameter.

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YES . . . even your automobile wheels are assembled with Sciaky Resistance Welding

Every weekend millions of families just like yours take their Sunday drive in automobiles with spot welded wheels!

Every *day* of the week outstanding manufacturers like Motor Wheel are turning out thousands and thousands of those wheels with Sciaky patented Three-Phase resistance welding . . . faster and at lower cost than ever before!

And as for *quality* — years of exhaustive testing proved eight Sciaky spot welds better than the previous twelve precision rivets.

Whether *you* make automobile wheels or not, if you *do* join metals in production . . . if you want it faster and better and at lower cost . . . see about Sciaky resistance welding — just like the wheel people did!

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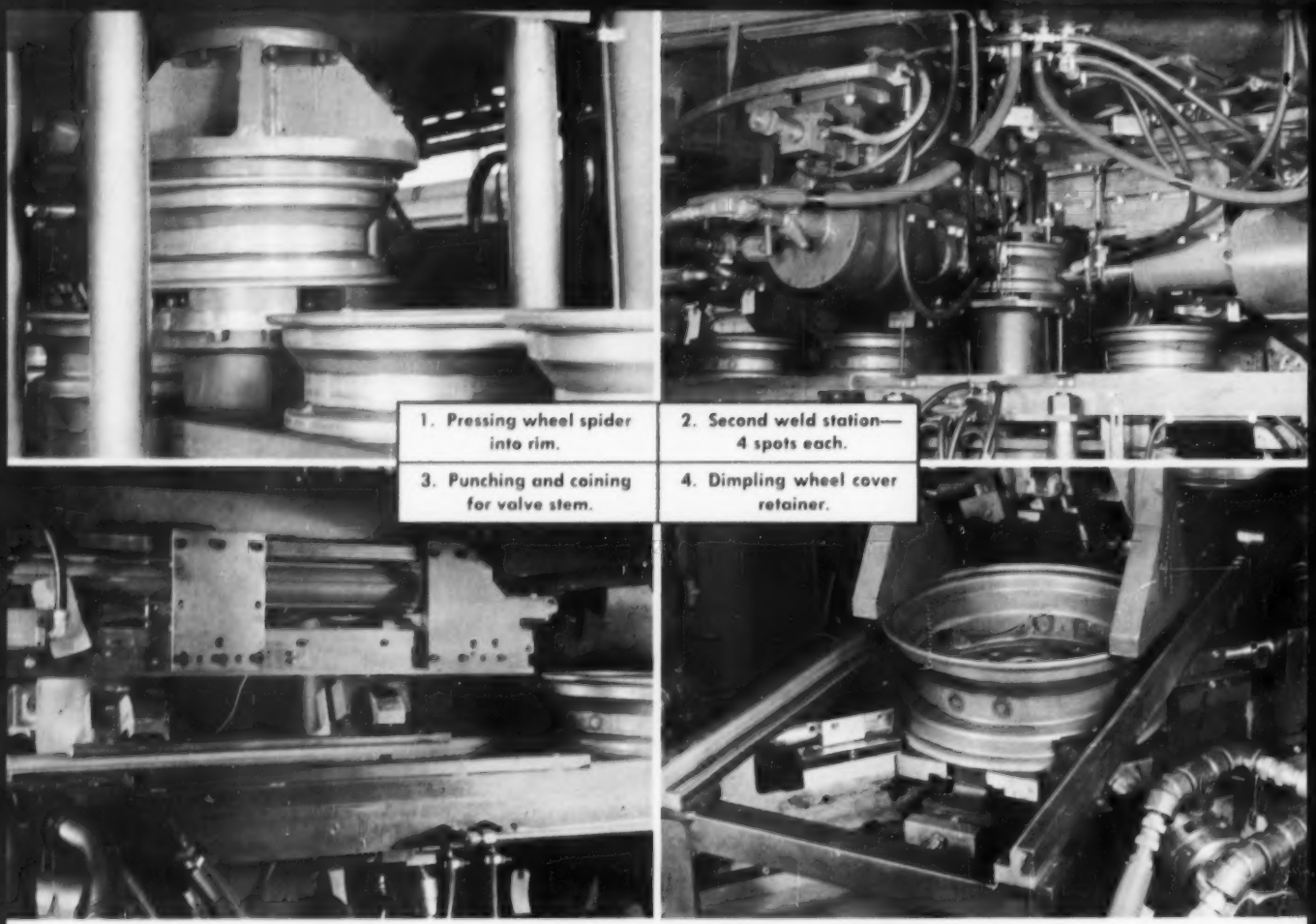
Largest Manufacturers of Resistance Welding Machines in the World

Turn the page for the impressive details of this tremendous improvement in wheel fabrication ▶



1. Pressing wheel spider into rim.
2. Second weld station—4 spots each.
3. Punching and coining for valve stem.
4. Dimpling wheel cover retainer.

Sciaky Resistance Welding Techniques

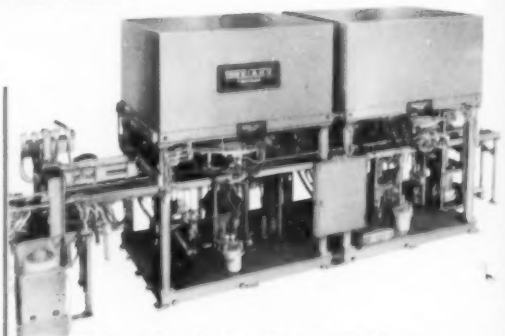
readily satisfy critical primary structures

with weld integrity and consistency in high production

Today Motor Wheel and other leading manufacturers are fabricating critically stressed automobile wheels with eight Sciaky Three-Phase spot welds instead of the previous twelve precision rivets. The elimination of the holes for rivets or other mechanical fastenings satisfies the air-tight requirements for tubeless tires as well.

A true example of automation, fully automatic Sciaky equipment includes press assembly of parts, piercing and coining of valve hole, and dimpling wheel trim retainers. Skilled labor no longer needed is made available for other important operations.

This tremendous advance in design concept and production methods is the result of years of exhaustive testing and development. Only Sciaky patented Three-Phase balanced load welding with 85% power factor (compared to 30% for conventional unbalanced load single phase) provides the integrity and consistency necessary to critical wheel assembly.



Write today for "Resistance Welding At Work," Vol. 4—#9, completely describing this outstanding application—yet another fine example of Sciaky basic thinking . . . resistance welding techniques to do *more useful work* at *lowest operating cost* with *maximum reliability.*

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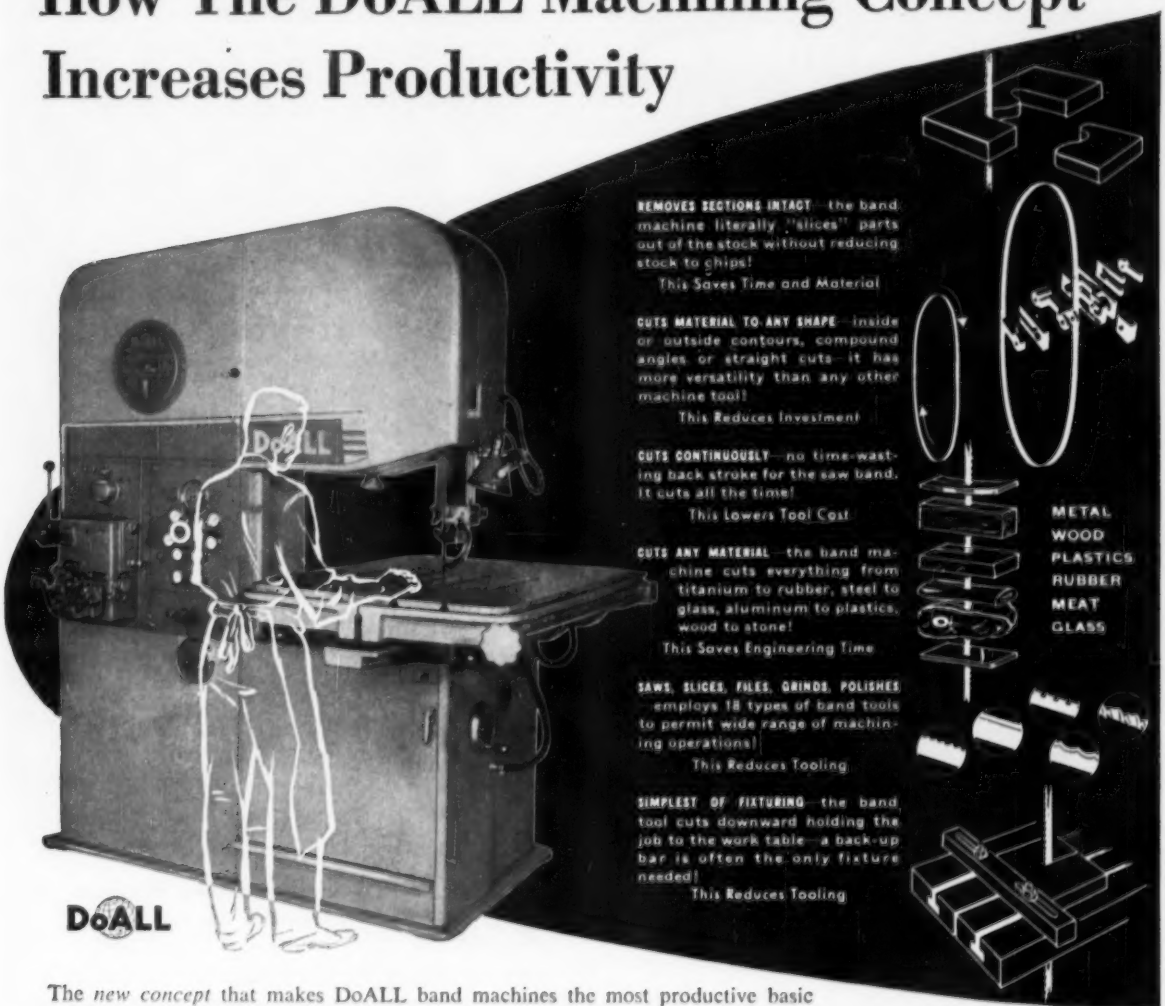
How The DoALL Machining Concept Increases Productivity


REMOVES SECTIONS INTACT—the band machine literally "slices" parts out of the stock without reducing stock to chips!
This Saves Time and Material
CUTS MATERIAL TO ANY SHAPE—inside or outside contours, compound angles or straight cuts—it has more versatility than any other machine tool!
This Reduces Investment
CUTS CONTINUOUSLY—no time-wasting back stroke for the saw band. It cuts all the time!
This Lowers Tool Cost
CUTS ANY MATERIAL—the band machine cuts everything from titanium to rubber, steel to glass, aluminum to plastics, wood to stone!
This Saves Engineering Time
SAWS, SLICES, FILES, GRINDS, POLISHES—employs 18 types of band tools to permit wide range of machining operations!
This Reduces Tooling
SIMPLEST OF FIXTURING—the band tool cuts downward holding the job to the work table—a back-up bar is often the only fixture needed!
This Reduces Tooling
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The *new concept* that makes DoALL band machines the most productive basic machine tools is illustrated in the diagrams. The cutting tool is a narrow steel band with hundreds of tool points—suspended between widely spaced tool holders. Hence the scope of its cutting action is not restricted. It is the world's fastest method of machining from solid steel. Everyday machining operations like slotting, notching, trimming, angular contour cutting, etc., as well as making special parts, can be routed to the DoALL Band Machine to gain enormous savings over former machining methods.

In addition, there is little or no waste of material or consumption of engineering time for fixturing and tooling with special machines.

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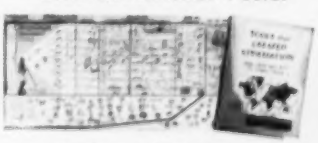
See New Films—

revealing this new concept for cost reduction in machining. "Production Band Machining" 30 minutes. "Production Tooling" 10 minutes.

Free-Educational Poster



Fundamentals of Economics in this age of machines and power are described in this Educational Wall Poster. Write for free copy.

THE DoALL COMPANY Des Plaines, Illinois,

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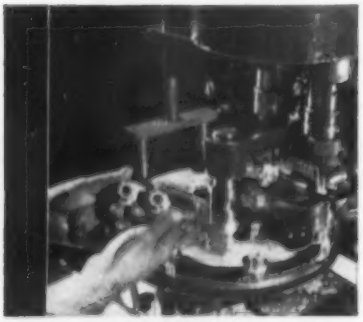

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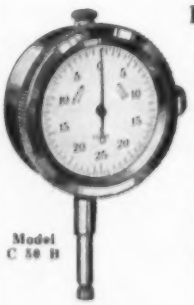

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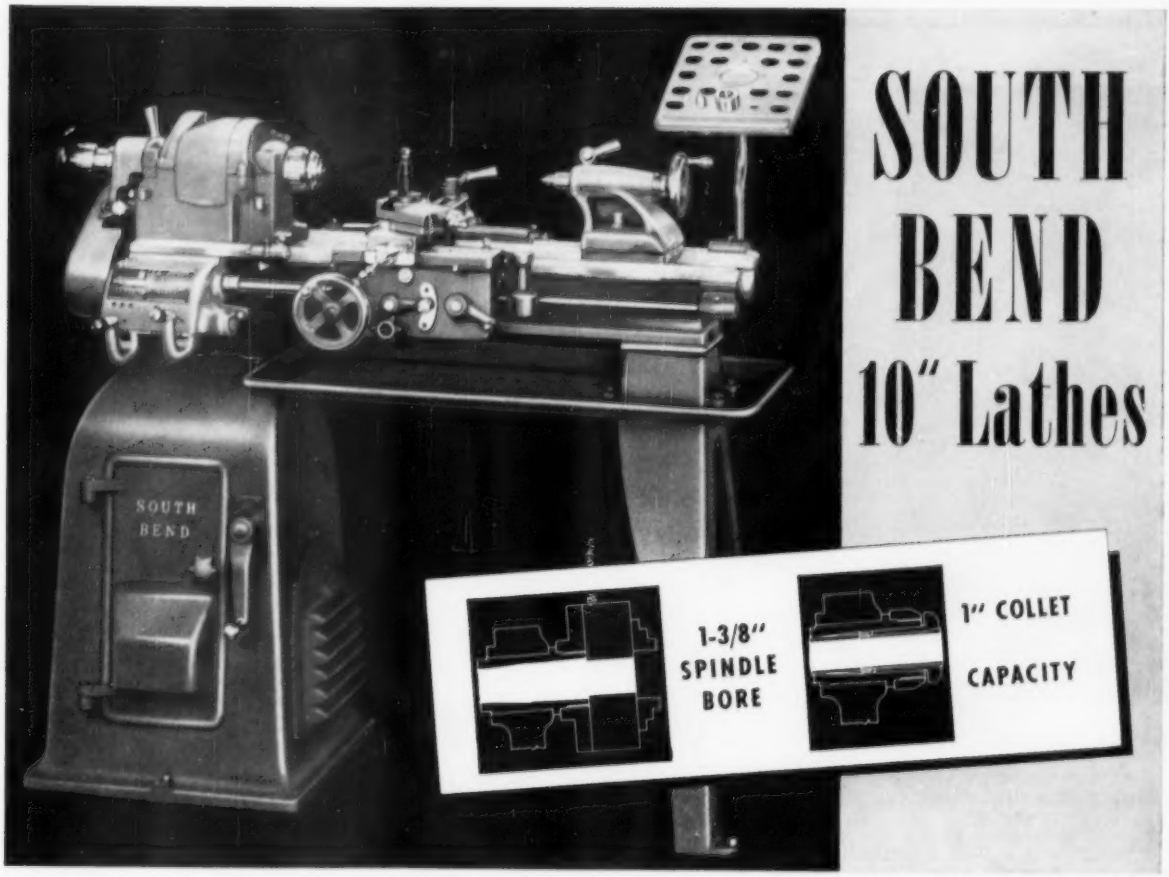

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SWING 10¼" over bed and saddle wings, 5¾" over cross slide.
COLLET CAPACITY.....1 in.
SPINDLE BORE.....1⅜ in.
BED LENGTHS...3, 3½, 4 ft.
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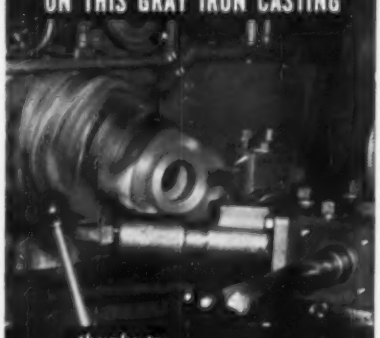

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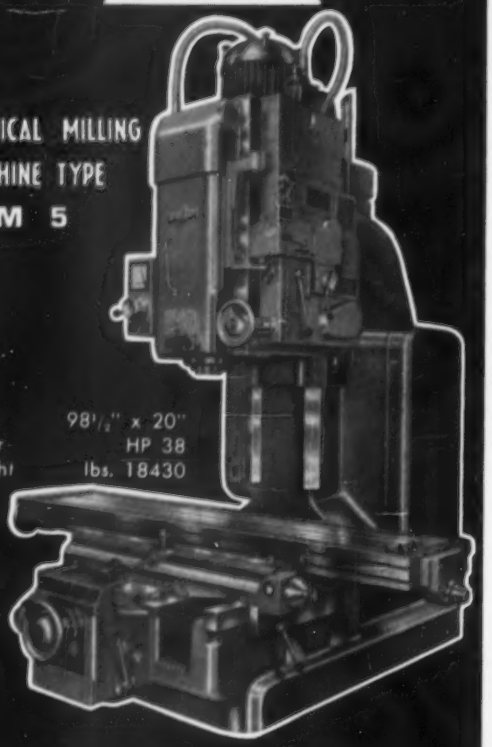

Table	98 1/2" x 20"
Power	HP 38
Weight	lbs. 18430

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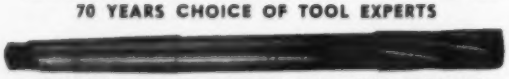

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New "PG" Wheel hikes production 40%!

1. PRODUCTION PROBLEM: The Albert Plating Works of Brooklyn, N.Y., bends, finishes and plates cold-rolled steel tubing chair backs. The finishing operation—removing stretch marks and blending the steel surface prior to plating—was formerly a two-step job: grinding with a Grit #180 set-up wheel, then surfacing with a grease-coated stitched buff wheel. Production was slow and costs high because of constant wheel dressing.

2. SOLUTION: A 3M Representative suggested that this company switch to the amazing new "PG" Wheel, Grit #320. The "PG" Wheel, lubricated with tallow, replaces *both* the set-up wheel and the buff, and has increased production 40%. Down time is cut to the bone because each "PG" Wheel lasts a *full week*. The "PG" Wheel produces a far superior finish on the tubing, making a superior and more consistent final chrome-plated surface.

A 3M Representative can help you solve your grinding and finishing problems, too. Call him today.

3M ABRASIVES

Made in U.S.A. by MINNESOTA MINING AND MFG. CO., St. Paul 6, Minn. Also makers of "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Brand Magnetic Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "3M" Abrasives, "3M" Adhesives. Export Sales Office: 99 Park Avenue, New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

Want more information?

MINNESOTA MINING AND MANUFACTURING CO.
Dept. AK-36, St. Paul 6, Minn.

☐ *Send me full details about the amazing new "PG" Wheel*
☐ *Please have 3M Representative call*

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YESTERDAY'S PIONEER · · · TODAY'S LEADER

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CONSTANT SPIRAL

(Die Sinking Cutters)

● The extensive line of the well known Weldon End Mills includes Tapered End Mills, Constant Spiral. Also known as Die Sinking Cutters, these end mills, filling a definite need, come in a wide range of sizes, giving a choice of many lengths and diameters. Weldon Tapered End Mills as standard stock items are all 3-flute, and offer a choice of ½°, 1°, 1½°, 2°, 3°, 5°, and 7° angles, taper on side. They represent the same high quality for which all Weldon End Mills are famous.

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THE WELDON TOOL COMPANY

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Convair, San Diego, does so. The secret? It lies in ordering extrusions in lengths more closely suited to production requirements: the mill makes no charge for cutting if the order exceeds 100 lbs. Scrap ends can be reduced from feet to inches by proper planning.

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Over 100 Types of INDEXING TURNTABLES
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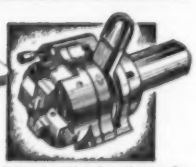

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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Pacific Coast Rep: *A. C. Berbringer, Inc., 836 N. San Pedro St., Los Angeles, Calif.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

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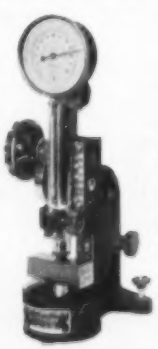
Pioneer American Standard SINCE 1907



MODEL D

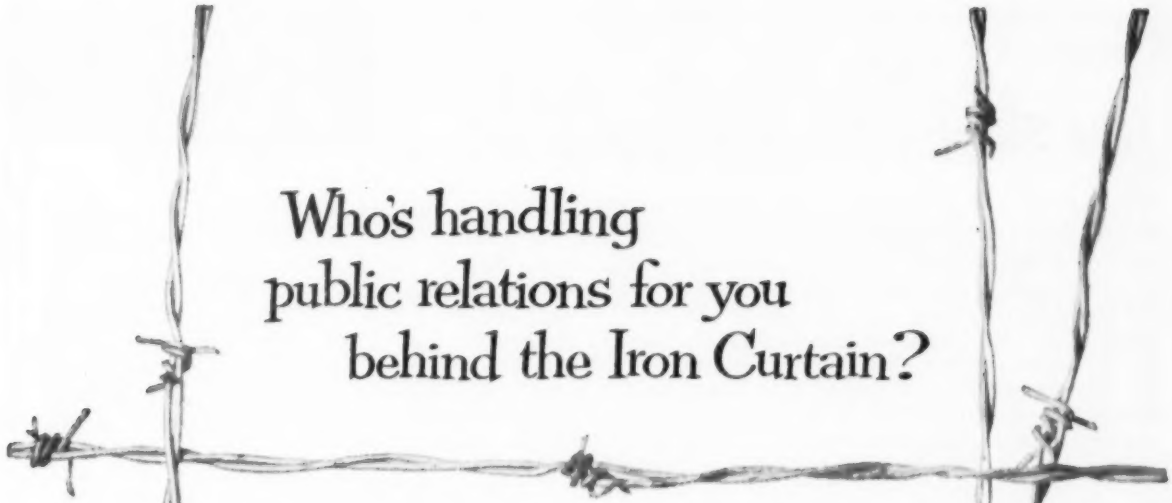
Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35B Van Wyck Exp.
Jamaica 35, N. Y.

MODEL C-2

Who's handling public relations for you behind the Iron Curtain?



It's not an easy assignment—or the kind you'll find many people volunteering for.

But there *is* an important "public relations" job to be done behind the Iron Curtain—for you . . . for America . . . for the whole concept of freedom, free enterprise and individual rights. This job is an opportunity and a challenge as well as a serious responsibility for American business. Fortunately, with your help, there *is* an agency that can do the job—*Crusade for Freedom*, which supports Radio Free Europe and Free Europe Press.

Both these powerful, privately operated organizations continually challenge the barrage of Communist misstatements and false truths. Using saturation radio broadcasts and mass newspaper drops from message balloons, Radio Free Europe and Free Europe Press are constantly on the offensive against the Red campaign to annihilate right, reason and national pride.

Continued and heated Communist protests testify to the tremendous effectiveness of Radio Free Europe and Free Europe Press. Support freely given by free American business and private citizens will increase this effectiveness and the scope of their operations. A contribution now is perhaps the best investment you can make towards a peaceful, prosperous world.

Give generously. It's your future!

Check list for business executives in the Crusade for Freedom

- ☐ Order display material for your company bulletin board.
- ☐ Plan a paycheck stuffer to fully acquaint your employees with the importance of the Crusade for Freedom.
- ☐ Plan to conduct an in-company solicitation.
- ☐ Match employee funds with *your Truth Dollars.*

PUBLIC SERVICE ADVERTISING COUNCIL

For campaign material and information write **CRUSADE FOR FREEDOM,** 345 East 46th St., N. Y. C. 17.

Gaging . . .

the Surplus Machinery Market

How long will the boom in surplus machinery last? You can go to a hundred different dealers, get a hundred different answers. That's because too many local factors are involved. Top dealers in the East and Midwest are waiting to see what happens this spring and summer. They figure that by then automotive cutbacks may make themselves felt all down the line, And, more important, the builders of new machine tools will have caught their breath from the tremendous influx of new orders, will have made substantial dents in backlogs, and will have been able to shorten delivery times considerably. A lot of top dealers think we'll know if the bloom is off the boom by July.

Traditional windup of all MDNA board sessions is a "how's business?" round robin in which each board member-dealer gets up and tells how things are going in his part of the country. It is highly significant that at the February 27 meeting in Chicago every one reported used machinery business in his area as "good to improving," and that none reported a declining trend. MDNA, incidentally, expects the biggest turnout in its history at its upcoming annual meeting at the Sheraton-Blackstone Hotel in Chicago May 23-26.

Even though prices are going sky high both to the dealer and to the customer (example: a turret lathe now selling for $7450 sold for about $3000 less six months ago), there's little fear of an inflationary crisis for the dealer, because buying-selling ratios are holding steady.

Sky-high auction prices have dealers hopping mad coast to coast. Take the recent Liquid Carbonic auction, in Chicago, where buyers, mostly direct representatives of metalworking plants, went completely overboard price-wise. "They lost their heads," one Chicago dealer reports, "—paid more for as-is condition average-to-poor machine tools than they would for a rebuilt and guaranteed machine of the same size from a recognized used machinery dealer."

Here's a couple of examples of the way prices ran at the Liquid Carbonic auction: one West Coast dealer watched a machine fall under the hammer for $4800, remembered that five years ago the same machine went for $3800. A Midwest dealer reports seeing a 1936 model 4-ft radial drill in poor condition go for $5100. Just a few weeks before, he had sold a radial of the same size and vintage for $4950—completely rebuilt and guaranteed. Not only that, the man who bought the $5100 machine had to take the machine from the second floor of the Liquid Carbonic plant, crate it and ship it back to his plant. The dealer sold the $4950 machine FOB car or truck.

And to add insult to injury, some of the direct buyers at the auction felt that the dealers were deliberately running the prices up—a rumor that is not only untrue, but one that could hurt reputable dealers.

Best sellers coast to coast: horizontal and vertical boring mills, all types of milling machines, especially heavy duty; all types of drilling machines, particularly radials; turret, engine and toolroom lathes, sheet metal fabricating machines, presses and other metal-forming equipment, optical comparators. In fact, the dealer can almost write his own ticket on any general-purpose toolroom and production machine in good condition, and on all kinds of materials handling equipment.

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All Machines have Air Clutch and some have Air Cushions and Motor Driven Ram Adjustment. Still set up in Plant
"If it's machinery; we have it."
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138 Mott St., N. Y. CAnal 6-2470

BENNETT MACHINERY CO.
GUARANTEED MACHINE TOOLS
BORING MILLS, 4½" bar Sellers, Floor Type
3½" bar Gilbert, Floor, 1943
4" & 3½" Bar Landis, Floor Type (2)
3" Bar Universal Thin Type, Triway
GRINDERS, 12"x48" & 16"x36" Landis, Late (2)
60" Hanchett Vert. Spin., No. 300 Hyd., Surf.
Nos. 2B Reid, 3B Abrasive, Surf.
36"x42" Pratt & Whitney Die & Surf.
30"x120" Hanchett Plane, Surf.
16"x36" Cincl. Plain Cyl.
LATHES, 28"x192" Con. L. & S., T.A., Late
14"-16½"x78" Con. Monarch, T.A.
20"x54" con. Reed Prentice '43
TURRET, No. 2H10 Libby 10½", '48
MILLER, 26SU Van Norman, '42
SHAPER—32" Cincl., '41; 24" Cincl. Univ., '48
SHAPER, VERT., 12" Pratt & Whitney, 1942
SLOTTER, 36" Rockford, Hyd., '44
375 Allwood Rd., Clifton, New Jersey
Phone: PRescott 9-8996 N. Y. Phone: LOngacre 3-177

"PRESS BRAKES"
Model #4510D Chicago (Dreis & Krump) All steel, Capacity 10' x 3/16"; 12' bed & ram.
Model #5140 Chicago (Dreis & Krump), All steel, Cap. 5' x 10 gauge.
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INTERSTATE MACHINERY CO., INC.
Venango at A St. Phila. 34, Pa.
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with Auto Temp Control. Sliding door, heavily insulated, substantial, accurate, dependable for machine shop, tool room, laboratory New
8"x12"x15" Inside 4.5 K.W. $300.00
12"x16"x20" Inside 9.0 K.W. $500.00
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BOX 9042A, HUNTINGTON, W. VA.

60" x ¾" ROLLER LEVELER
McKay Universal 2-H1; New 1942; seven 60" x 10" Rolls; ¾" mild steel capacity; 75 H.P. AC motor drive; EXCELLENT CONDITION.
BARRON MACHINERY COMPANY
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"PRESSES O.B.I."
108 Ton Thomas—open back inclinable, New 1947. Back geared—Stroke 5"; Bed 30" x 42".
#7B Niagara—open back inclinable, Cap. 65 Tons —Stroke 2"; Bed 23" x 32½".
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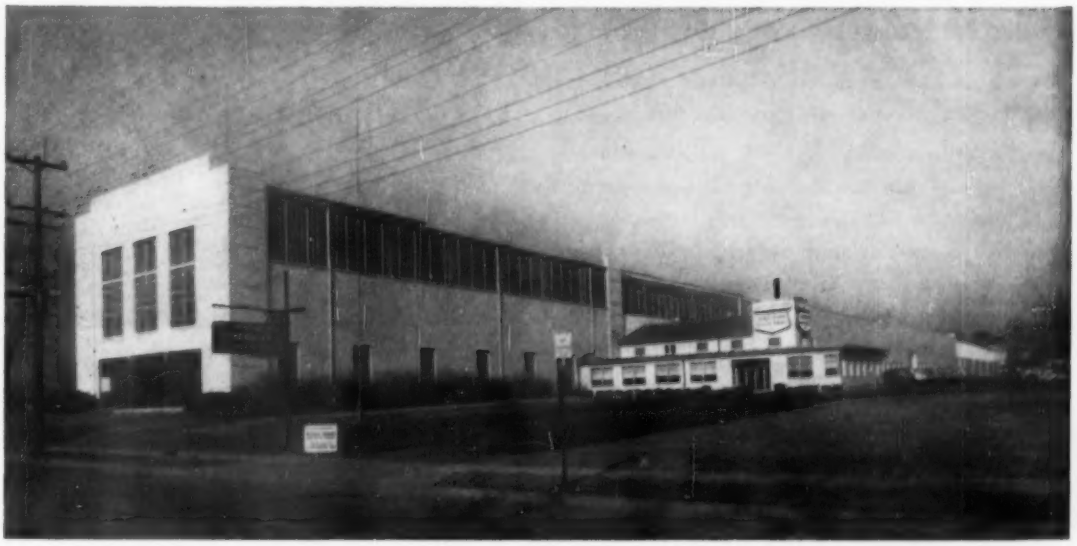
Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY



BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

4'-13" col. American Triple Purpose, m.d. on arm
5'-14" col., Carlton, m.d.
5'-19" col. Fosdick "Economax", m.d. on arm
7'-16" col. American Triple Purpose, m.d.
7'-17" col. American, Universal Table
8'-17" col. American, Triple Purpose
8'-17" col. Dreses, gear box, m.d.
Zeus Precision Universal Bench Type Radials, m.d., new
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 4 Fosdick, 8" overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. 18 Cincy-Otto Bench Model, m.d.
No. ½, 1, & 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 2 Avey Single Spindle, m.d.
1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
2 spindle Allen, belted m.d., 5" overhang
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, style VHP, m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland & Gifford High Speed, 8" overhang, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle No. 2 Avey, High Speed, m.d.
3 spindle Leland & Gifford #1LMS—High Speed, late, m.d.
3 spindle Leland & Gifford High Speed, Model 3MS, m.d.
4 spindle Leland & Gifford m.d. on each spindle
4 spindle No. 4 Allen High Speed, m.d., 1943
6 spindle Leland & Gifford, m.d. on each spindle, No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.

HORIZONTAL DRILLS

3 way Natco Horizontal Drill, consisting of 3 E13 Holeunits
No. ½B-50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle deep Hole Reaming Machine, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes, 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942

MULTIPLE SPINDLE DRILLS

24" Barnes All Geared Self-Oiling, 3 Spindles, m.d.
#1150 Moline Multiple Spindle Drill Press
No. 3 Baush, m.d., 18x30" head
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 M.T.
4 spindle Niles-Bement-Pond, m.d., 12' rail, No. 5 Taper
No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W.F. & John Barnes Vertical Drilling Machine, m.d.
3 spindle Rockford 12" Gang Drill, m.d.

UPRIGHT DRILLS

D6 Colburn, heavy duty, m.d.
20" Cincinnati Bickford Super-Service Prod. Drill, m.d.
24" Aurora, m.d.
24" Cincinnati-Bickford, m.d.
32" Aurora, belt drive
36" Cincinnati-Bickford, belt drive
No. 2 Colburn Mfg. Type, m.d.
No. 315 Baker Heavy Duty, s.p.d.
No. 4—48" Defiance Machine Co. Drill, m.d.
No. 417 Baker, m.d.
No. 513 Baker, m.d.
Model 150 Baker Heavy Duty, m.d.

GEAR SHAPERS

No. 4 Fellows Enveloping Gear Generator, m.d.
No. 12 Fellows Gear Shaving Machine, m.d., late
No. 6 Fellows, belt drive
No. 7, 7A Fellows Gear Shaper, belted m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 6I Fellows, belted motor drive
No. 6I Fellows, gear box, m.d.
No. 61A Fellows, m.d., latest type
No. 64B Fellows, m.d.
No. 645A Fellows, m.d.
No. 645A1 Fellows, m.d.
No. 72 Fellows High Speed Spur Gear Shaper, m.d.
No. 75 Fellows High Speed, m.d.
No. 75A Fellows, H.S. Spur & Helical Gear Shaper, m.d.
No. 712 Fellows, m.d.
No. 715A Fellows High Speed Gear Shaper, m.d.

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No. 12 Gleason Straight Tooth Bevel Gear Roughter, m.d.
No. 36 Gould & Eberhardt Bevel & Spur Gear Roughter, m.d.
Gleason Spiral Bevel Gear Roughter, m.d.
No. 36BM Gould & Eberhardt Spur Gear Cutter
No. 3—30" Brown & Sharpe Gear Cutter
No. 4N Fellows Gear Burnisher
No. 6B Fellows Gear Burnisher
Cincinnati Gear Burnisher, m.d.
3" Gleason Gear Generator, m.d.
8" Gleason Gear Generator, m.d.
11" Gleason Gear Generator, m.d.
No. 4—48" Brown & Sharpe Spur Gear Cutter, helt
No. 6—60" Brown & Sharpe, m.d.

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EMCO

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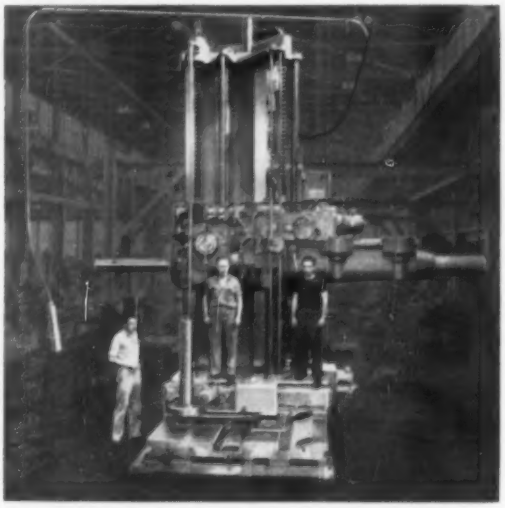
He wanted it to be rebuilt right and he wanted to pay a fair price.

This fine machine was reconditioned in our plant from the floor up. We appreciate the confidence thus placed in us.

Machine tools rebuilt by Motch & Merryweather are reliable because, first, we choose good equipment to start with. Then a 50-year experience goes to work in accordance with a set of clearly defined standards. Result: a definite asset to your production and accuracy. The Motch & Merryweather way of doing business is indicated by the familiar name plate shown below—an unconditional guarantee of complete satisfaction.



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42" Swing x 72" Centers. NORTON TYPE C CYLINDRICAL GRINDER, 16" Extra Heavy Frame, 20 HP wheel motor, power rapid traverse, also extra equipment Ser. C-22459, New in 1947. Replacement cost $40,000. OUR PRICE $17,500.

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Fonte-Burt Vert. 26" sw, new 1941
36" Bullard VTL, side hd, 1941
#49 Heald Boremastic, new 1944

DRILLS

1 spdl, 14" sw, #2 Avey, new 1945
1 spdl, 24" sw, #2MA6 Avey, new 1942
1 spdl, 26" sw, #4M8 L-G, hydraulic
2 spdl, 24" sw, #2 Avey, AC MD
3 spdl, 20" sw, #2LM8 L-G, 1942
3 spd, 24" sw, #3M8 L-G, new 1943
3 spdl, 24" sw, #3M8 Allen, 1942
4 spdl, 14" sw, #2LM8 L-G, new 1942
4 spdl, 20" sw, #2LM8 L-G, new 1944
6 spdl, 26" sw, #2LM8 L-G, new 1943
6 spdl, 26" sw, #2LM8 L-G, new 1943
16 spdl, For #K60H, #2 taper, 1944

BORING MACHINES

100" N-B-P, 2 swivel hds, DC MD
Fonte-Burt Vert, 26" sw, new 1941
36" Bullard VTL, side hd, 1941
#49 Heald Boremastic, new 1944

GRINDERS

6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1943
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1943
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x48" Landis Type C, new 1941
16"x72" Hill-Clarke, AC Mot. Dr.
16"-20"x72" Norton, AC MD, 1941
42"x72" Norton, swivel, new 1947
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton Plain Cyl.
20"x192" Norton AC Mot. Dr.
24"x84" Van Norman, C S
24"x264" Norton, AC MD, Rebuilt
20"32" Gap x 144" Norton Pl. Cyl.
14"x48" Landis Type C Univ, chuck
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-36 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940

LATHES

16ML-16"x36" LeBlond Auto
#16ML-16 LeBlond, Semi-Auto, 36" cc
14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
36"x126" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" cc N-B-P, ser. 3380
#5W Cinn Acme Univ. Turret,
#3AL Glishit, cross-slide tur, 1941
#7A J&L 10" sw, tooling, 1942
#3H 16 Libby H.D. Tur. 1942
#4A W&S Turret, new 1944
#4F1 Fastermatic, tur, 32" sw, 1944
#8D Potter & Johnston, new 1941

MILLERS

54"x20"x16 Ingersoll Slab, 1934
54"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical
10"x80" P&W Med. B Thread Mill
#CT L-B Thread Mill, new 1942
#08 Cinn. Vert. back lash, 1942
#4 Cinn. H.S. Dial Type Pl. 1942
#36 Van Norman, Rebuilt, 1941
#1-18 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30' Hamilton, 4 heads

MISCELLANEOUS

#3L La Pointe 15T Hertz. Broach
6" Goss & DeLeeuw, 8 spdls, 1941
#306 Barnes Vert Hone, new 1942
15 Ton Hyd. American Press, 1946
#11RD 2 Hd. W&S Tapper, latest
#12HS G&E, 12" cap. Gr. Hobber
#36HM G&E 3 Spdl. Bevel Gr.
#61A Fellows Gr Shaper, 18" cap.
#3A Kaufman Prou. Tapper, 1947
16 ga. 42" Economy Power Shear
15 T Toledo Overhead Crane, 39½'

PHONE: CEntral 6-0500

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- SBD 72-30 American Duplex Vertical Broach 30-ton 72" stroke. 1943.
- 36" x 240" Centers Niles Timesaver Engine Lathe. New in 1941.

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10—Fellows Straight Line Gear Generators with rack type cutter. Serials 17960 to 22694. Attractive price for the lot.

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USED MACHINERY

Niagara 12' Power Square Shear, No. 14-Ga. Cap.
Brown & Sharpe No. 2 Surf. Grinder All Motorized
G&L 3" Bar Table Type Horiz. Boring Mill
Colburn 2-Spindle Box Col. Heavy Drill M.D. 20".
Milne (Timesaver Model) 32"x14' Bed Grd. Hd. M.D. Lathe 7' Centers.
Lambert 4" Bar Table Type Horiz. Boring Mill.
Ohio 24" M.D. All Grd. Feeds Shaper 1942 model
Cincinnati No. 5 Rect. Overarm Grd. Hd. Plain Horiz. Miller.
Baush 44" Vert. Boring Mill 2 heads.
Knight #40 Vert. Jig Borer.
American 20"x8' Grd. Hd. Lathe motor in base.
Landis 20"x72" and 16"x96" Plain Ext. Grinder.
Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table
W & S No. 2-A Grd. Hd. Univ. Turret Lathe chucking
Rivett No. 104 A.C. M.D. Internal Grinder.
Milwaukee Nos. 2-B & 3-B Horiz. Plain Millers D.O.
Cincinnati 36"x36"x10' D.H. Planer 2 Hds. Box Table
Heald No. 72A-3 Hydr. Int. Grinder Rad Head Sp.
American 28"x20' Bed Grd. Hd. Lathe
Cleveland 30"x8' Table Open Side Planer 2 Hds.
Cincinnati No. 2 HI-Power S.P.D. Vert. Miller.
G & L 3" Bar Horiz. Boring Mill.
Barnes 20" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf. Grinder 26" chuck.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 16"x8' bed Q.C.G. Lathe 1939.
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
Foster 2-F Fastermatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
P & J #2 Auto. Prod. Miller, 2 Tables.
Cincinnati #2, #3 & #4 Centerless Grinders, all Motor Driven.
Bullard 24" Vert. Turret Lathe.
Lynd-Farquhar 26" stroke open-side Shaper Planer.

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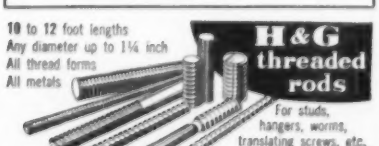

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LaPOINTE 10-54" Vertical, Model SRV, cap. 20,000 lbs.; 54" stroke; new 1947
LaPOINTE SVR 15/66" single Ram Vert.; hydr.; M.D.; late
OILGEAR 3XA Horizontal, cap. 20,000 lbs.; 36" stroke, Hydraulic; late
OILGEAR XL-6 Horizontal; cap. 3-tons; 36" stroke; latest type

DRILLS — Manufacturing
ALLEN No. 3, 4-spindle, No. 4 M.T.; late
AVEY No. 2, 2-spindle Drill Press; late type
BARNES H-2 Hydram; 2" cap.; 22 swing; No. 3 M.T.; Hydraulic; M.D., late type
BARNES model H-3 Hydram; late type
BARNES No. 201¼, 4-spindle; No. 4 M.T., 20" swing; M.D., late type
BARNES No. 262, Heavy Camel Back; late
LELAND-GIFFORD No. 2LMS, 26" single spindle
LELAND-GIFFORD No. 1LMS, 4-spindle; late
LELAND & GIFFORD 2ILMS 2 spindle; late
LELAND-GIFFORD model 2LMS, 2-spindle; latest

DRILLS — Multi-Spindle
BARNES No. 240, 2-spindle Deep Hole Drilling and Boring; late type
NATCO Model 84B "Hole Steel"; 60 adjustable slip spindles; late type
NATCO Model ES H.S. 10-spindle adjust.
NATCO Model C5 H.S. 10-spindle adjust.
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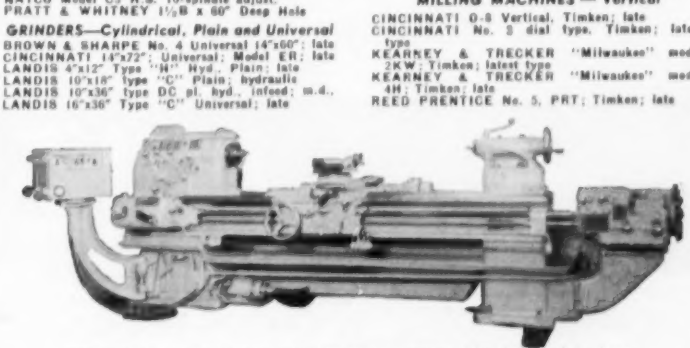
BROWN & SHARPE No. 4 Universal 14"x60"; late
CINCINNATI 14"x72"; Universal; Model ER; late
LANDIS 4"x12" Type "H" Hyd., Plain; late
LANDIS 10"x18" type "C" Plain; hydraulic
LANDIS 10"x36" type DC pl. hyd., infeed; m.d.,
LANDIS 16"x36" Type "C" Universal; late
NEW HAVEN 42"x120" centers geared
NILES 30"x25', 30"x46' bed, Sgle. End Ber., "Timken"
NILES 36"x100" c.c., "Time Saver"; late
NILES 42"x216" centers Geared Head; late
PRATT & WHITNEY 16"x30" c.c.; Timken; late
SPRINGFIELD 14"x43" geared; M.D., late
SUNDSTRAND 8"x15" Auto mfg., late
SUNDSTRAND 12"x22" Automatic; late

LATHES, Turret
GISHOLT 1L, 2L Univ. Saddle type; Timken; late
LIBBY 1HG, 6" hole, long bed; late
LIBBY 4H-12" hole, M.D. Turret Lathe; M.D.
MAGDEBURG model MWF-250 Universal; late
MOREY No. 2 ram type, Timken; latest type
MOREY No. 4 ram type; Full Univ.; latest
POTTER & JOHNSTON No. 6DT Automatic Chucking & turning; late type
WARNER & SWASEY #1 "Electric", M.D., late
WARNER & SWASEY No. 2 Ram type; Timken;
WARNER & SWASEY #1A; 3, 4, 4-A; Univ. Ram Type; late

MILLERS—Profile and DUPLICATING MACHINES
CINCINNATI 28-60 Hydro-Tel; 4 Spindle; Tracer Control; Timken; late
CINCINNATI 5-60 Hydr.; Tracer Control; late
P. & W. "Keller" Model GG 1210; latest

MILLING MACHINES — Vertical
CINCINNATI 0-8 Vertical, Timken; late
CINCINNATI No. 2 dial type, Timken; latest type
KEARNEY & TRECKER "Milwaukee" model 2KW; Timken; latest type
KEARNEY & TRECKER "Milwaukee" model 4H; Timken; late
REED PRENTICE No. 5, PRT; Timken; late



MONARCH 18"x72" Lathe with "Keller" Copying Attachment; late type.

LANDIS 20"x144" Plain Cylindrical Gap; M.D.
LANDIS "D" 25"x72" Crank Pin Grinder;
LANDIS "C" 18"x72" Plain; late type
LANDIS type "DCP" 10"x72" hydr., late
NORTON 4"x12" model CTU Plain; new 1953
NORTON 6"x18" Type "C" Plain Cyl.;
NORTON 10"x36" Plain; motor drive
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NORTON 16, 26"x72" Plain, Cylindrical;

LATHES—Engine and Mfg.
GISHOLT No. 12 Hydraulic Automatic Chucker; late
HENDEY 16-24"x30" centers; Timken; late
HENDEY 24"x36" centers, M.D.; late type
JONES & LAMSON "Fay" 20"x25" Auto.
LeBLOND Model 7ACL Crankshaft; 9"x 30"; M.D.
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LeBLOND 27"x144" centers; motor drive
LODGE & SHIPLEY No. 3-A Duomatic
LODGE & SHIPLEY No. 5, 24" & 96" centers; DUOMATIC; Timken; late
LODGE & SHIPLEY 12"x30" G.H. Toolroom; late
LODGE & SHIPLEY 14"x30" Centers; late
LODGE & SHIPLEY 18"x30", 18"x54"; Timken; latest
LODGE & SHIPLEY 20"x48", 20"x144"; Timken; late
LODGE & SHIPLEY 20"x54" Gap; Timken; late
LODGE & SHIPLEY 22"x48"; Timken
LODGE & SHIPLEY 24"x48"; Timken
LODGE & SHIPLEY 24"x96"; Timken
LoSWING 4"x60", 4"x84" centers
MONARCH 18"x48" Model CBB; late type
MONARCH 14"x54" centers; model AA
MONARCH 22"x284", 22"x336" cc, Model M; late
MONARCH 12"x30" model "KK" Eng., Timken;
MONARCH 24"x60" model "M", Timken
MONARCH 24/36"x48" model "N", air tracer; 60 series; late type
MONARCH 16"x30" model "C", Timken
MONARCH 18"x48" "CBB" (raises to 20½"); Timken; late type
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BESCO Model EB4, 40-ton, cap. Back Flywheel; New
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BLISS No. 410A, 525-ton double action toggle drawing press; M.D.
NATIONAL No. 5 "Maxi-Press" 1,000 ton cap., H.S. Forging Machine; M.D.
NIAGARA No. 66E, 35-ton Press; late type
V & O No. 3 30-ton O.B.I. Press; late type
WATERBURY FARRELL No. 9, 125-ton cap. Blanking Press; M.D.

MISCELLANEOUS
BAKER No. 5 Keyseater; motor drive
BARNES No. 172, Honing; late type
GORTON No. 3K, Precision Matrix Engraver
GRANT No. 183, 2-spindle Riveting Machine; late type
KANE & ROACH "Ohio" cold roll forming machine; late type
MANVILLE No. 1 Auto. Screw Slotter; late
MICROMATIC No. 7 Hydr. Vert. Hone; late
MORTON 24" Keyseater; late type
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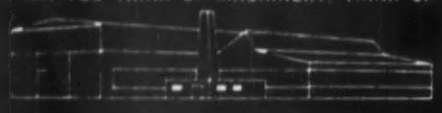

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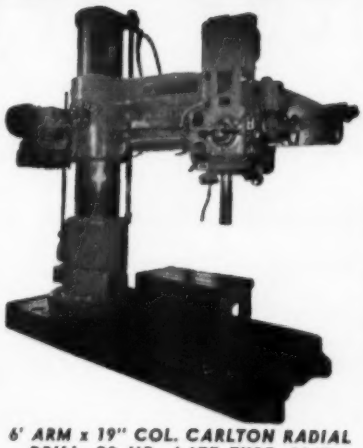

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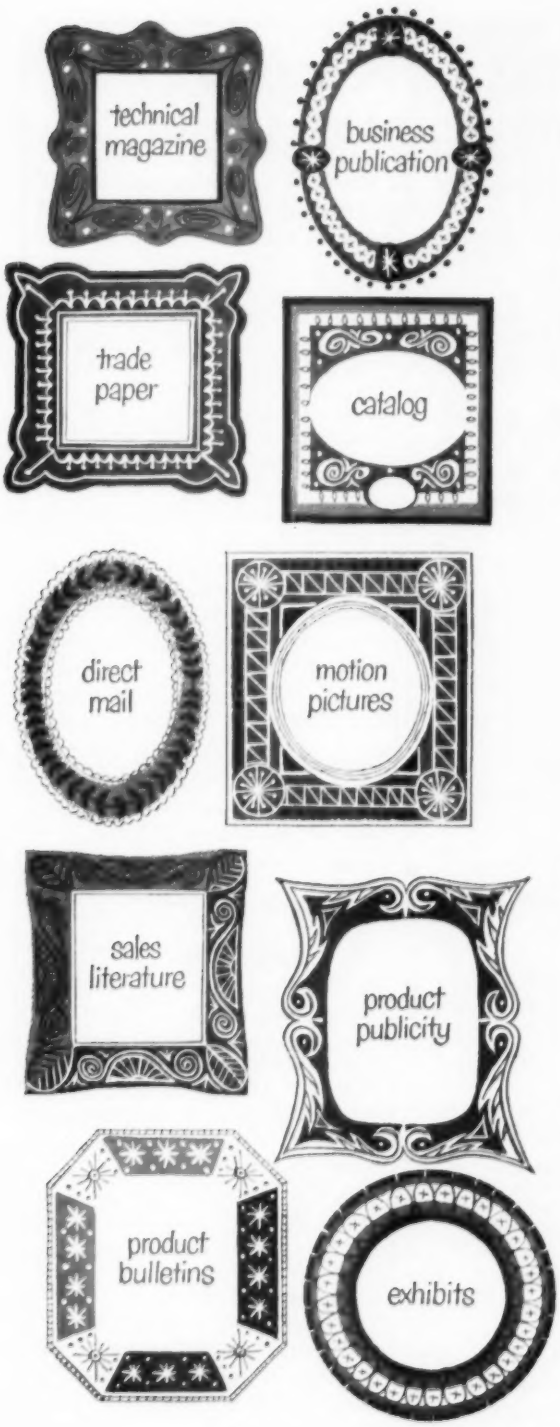

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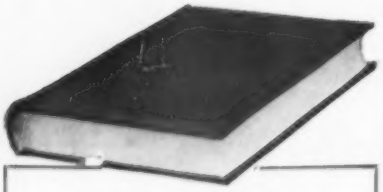

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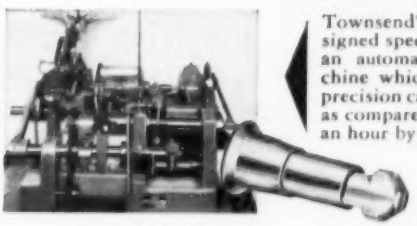

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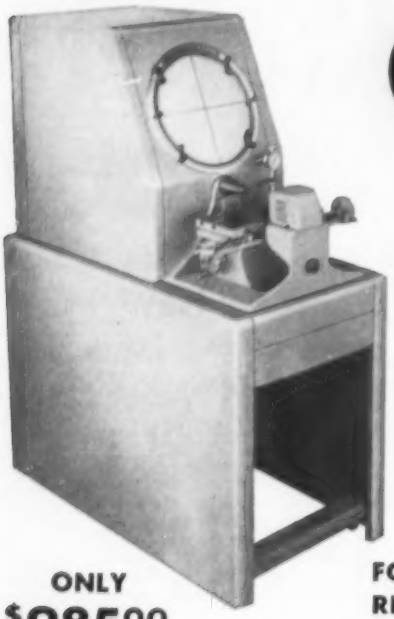

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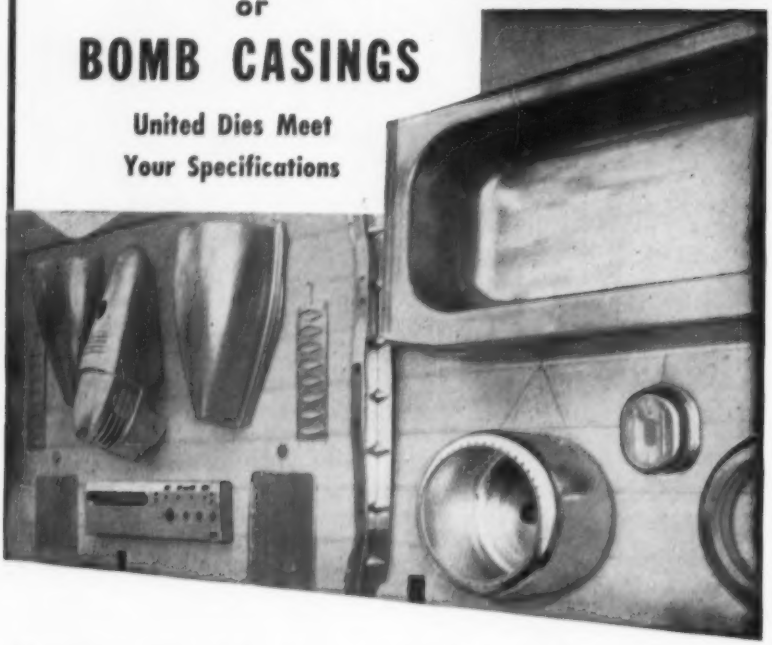

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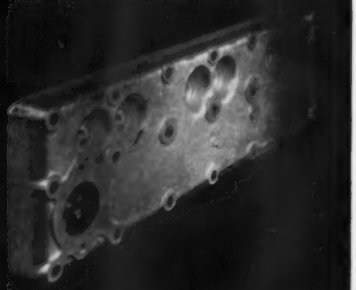

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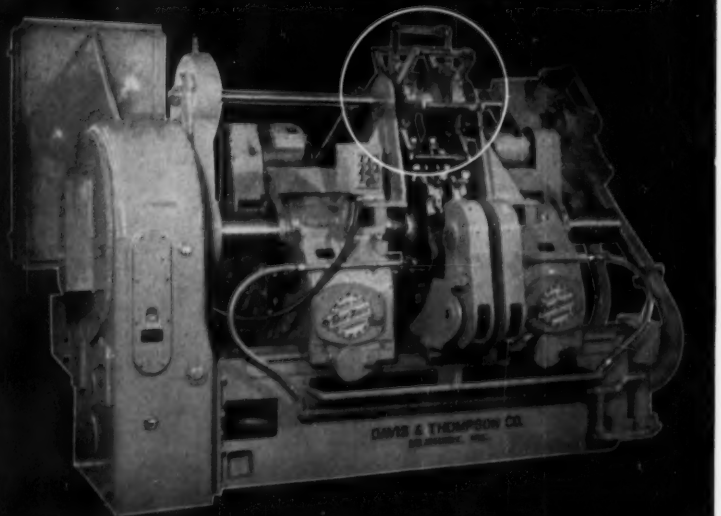

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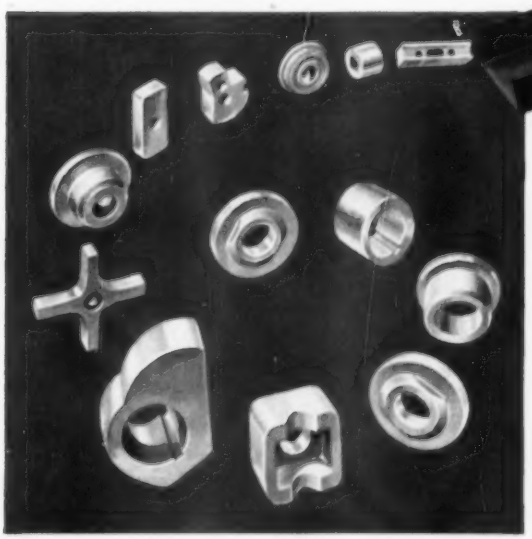

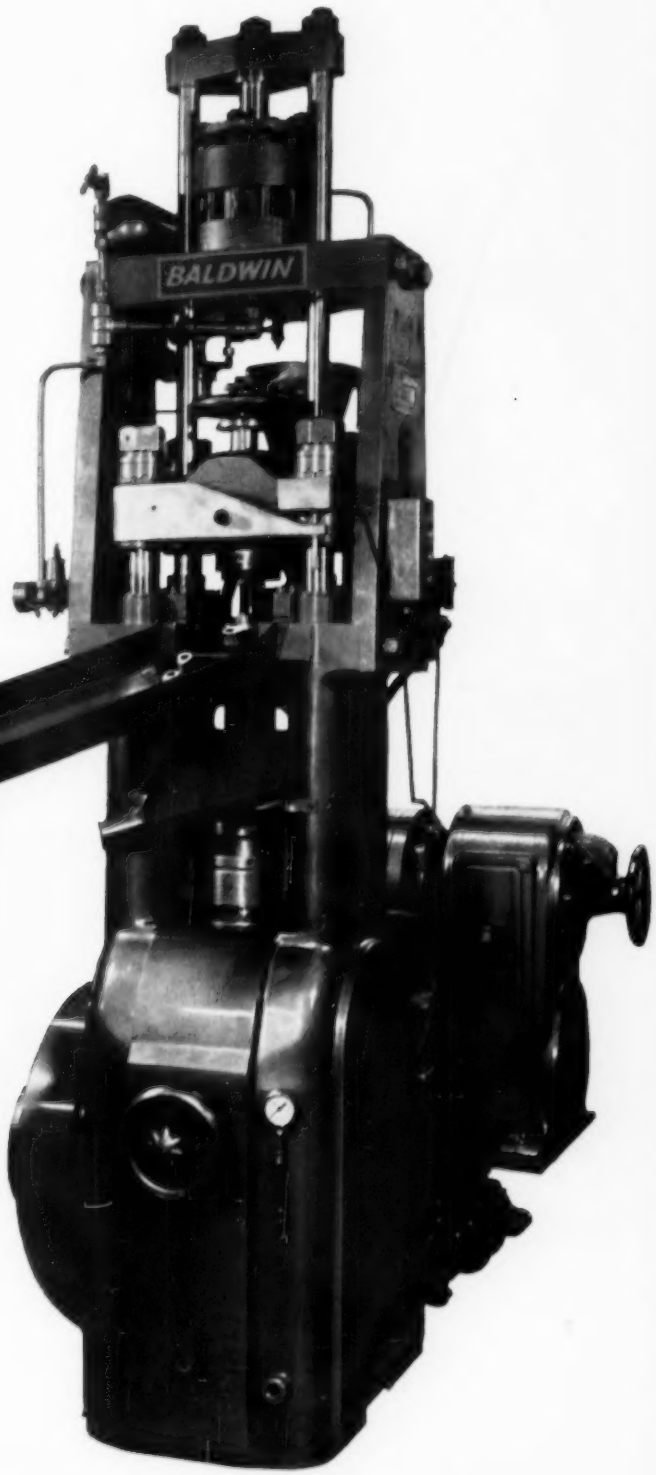

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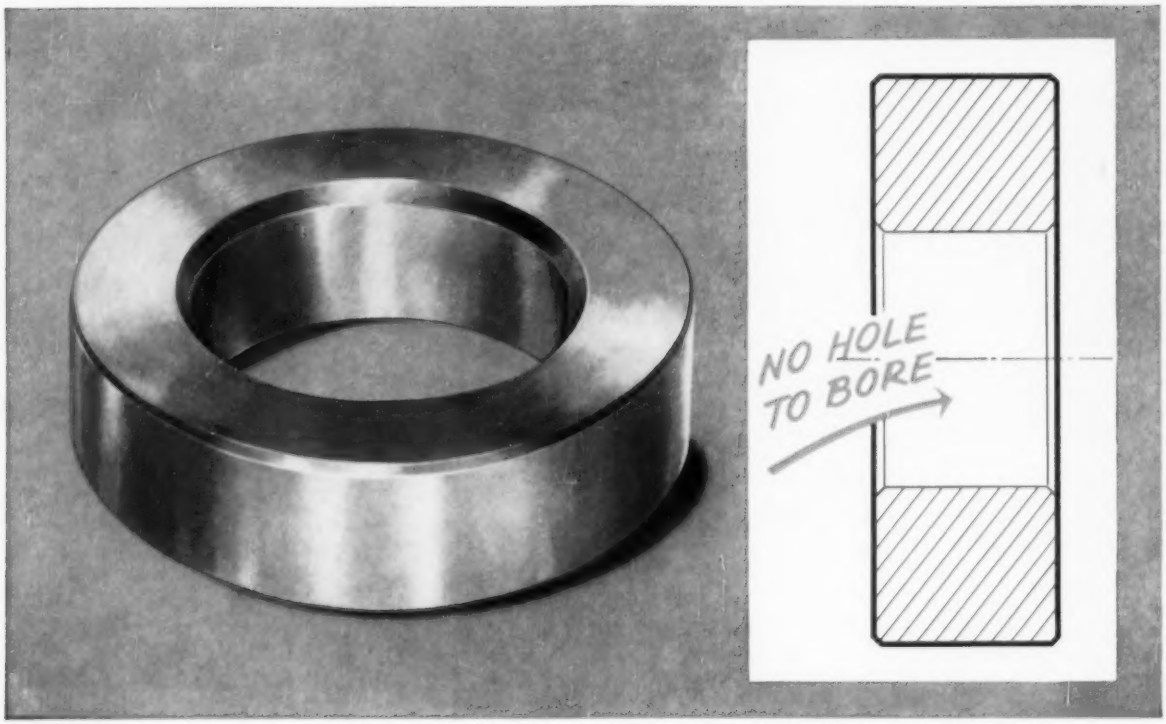

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